PERFORMANCE OF MAIZE (<u>ZEA MAYS</u> L.) AT VARYING PLANT POPULATIONS AS INFLUENCED BY GENOTYPE AND FIELD ENVIRONMENTS

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN AGRONOMY AND SOIL SCIENCE

SEPTEMBER 1971

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ACKNOWLEDGMENT

Grateful appreciation is due the East-West Center for the grant awarded me which made this study possible.

I am also grateful to the University of the Philippines, College of Agriculture which, in one way or another, was instrumental in my success in getting a scholarship to pursue graduate studies in Agronomy.

Many thanks are also due to the wonderful people at Waimanalo Experiment Station, Kauai Branch Station, and Volcano Experiment Station who provided invaluable assistance in the conduct of the study.

To my wife, Phoebe, my heartful thanks for her continuous inspiration and encouragement in carrying on this work.

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INTRODUCTION

Corn (Zea mays L.) has been cultivated in Hawaii for many years. Varieties grown here have a wide range of adaptability being grown under various conditions of soil, soil moisture, elevation and season. Early reports have indicated that corn was grown in Hawaii throughout the year at lower elevations and performed better on the leeward side as a winter crop. Although corn is in great demand for animal feed, it has never become a major crop in Hawaii. Most of the local supplies are imported from the mainland. In recent years, a number of corn seed producers from the mainland, taking advantage of the favorable warm weather in parts of the state, established winter season seed nurseries. The success of the winter seed nurseries has led to summer season nurseries as well. This interesting development may pave the way for an increase in commercial corn production in Hawaii as more land is withdrawn from sugar cane or pineapple production.

The wide range of environmental conditions in Hawaii would require a complex of corn production techniques and suitable varieties in order to assure the success of commercial ventures. Photoperiod, solar radiation intensity and temperature variations during the year affect yields even with adapted varieties. For this reason, it has been a normal procedure among plant breeders and seed producers to test the performance of a new variety[1] for several cropping seasons, usually in

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[1]Technically, variety refers to any strain derived from open pollinated seeds. In this paper, as has been commonly used in many published articles, the word is used to refer to any named strain, whether it is a hybrid or a real variety.

different locations having varying environmental conditions, before it is recommended for commercial production. As a result, planting dates for most field crops are usually adjusted to take advantage of the most favorable environmental conditions in order to obtain maximum yields. There may be several reasons for maximum yield at any planting date but generally temperature, light, and moisture are of principal concern.

With the current trend towards maximizing productivity per unit area of land, increasing plant density in combination with vast resources and technology for crop production imposes the requirement of high varietal tolerance to crowding. It is now widely accepted that genotypes differ greatly in their contribution to both stover and grain yields under comparable crowding pressures. Corn grain yield is a product of grain per plant and plant population, hence, it is necessary to study the effects of plant population on yield for a wide range of conditions. The reaction of a hybrid at high planting rates may be viewed as an interaction between its genotype and the environmental conditions which prevail in dense populations. Examination of the response of new varieties to different planting densities would therefore be required under current cropping practices.

Varieties suitable for commercial corn production in Hawaii are currently available and further testing and improvement of varieties is being done. However, no comprehensive information is available on the performance of these varieties under the many environmental conditions prevailing in the islands.

In recent years, the problems of optimum dates of planting and plant populations for maximum grain yields have been extensively investigated on the mainland. As a result, the grower in tropical regions like Hawaii is confronted with a great deal of literature indicating the need for high plant populations in order to maximize yields. Much of this information, however, has been derived from the Corn Belt area where growing conditions are far different from those in the tropics. Thus, it appears that a population-environment study is warranted.

The objectives of this experiment were:

1) to study the response of a representative sample of parental lines and hybrids to the environmental conditions at three distinctly different locations at a constant level of fertilization; and

2) to study the effect of date of planting and location on the yield and other measureable responses of these varieties to plant population.

LITERATURE REVIEW

Corn has a remarkable diversity of types and varieties adapted to a wide range of environmental conditions are in cultivation. From latitude 58° N in Canada, the culture of corn passes without interruption through the tropical regions and on to the frontier of agriculture in the Southern Hemisphere, latitude 35° to 40° S.

It has been widely recognized that a change in latitude brings about a marked change in vegetative and reproductive development because of the alteration in daylength, Jones and Huntington (1935). Garner (1923) studied the effect of daylength on a yellow dent variety of corn and found that 18 hours of illumination produced larger, taller and longer-lived stalks with longer but poorly filled ears as compared with the controls exposed to normal summer daylength. Kiesselbach (1950) observed that with a daylength of 8 to 10 hours, as opposed to the natural level of 14 to 15 hours, all varieties tested showed reduced vegetative growth and earlier induction of reproductive development. If daylight is artificially shortened to 10 to 12 hours panicle shooting and blossoming are accelerated and the total vegetative cycle is shortened (Schrimpf, 1966). The longer northern days would therefore delay maize development. Light may also play a role in delaying maturity, although in the northern latitudes with very long days, it is the unfavorable temperature conditions which determine the length of vegetative growth. Reduction in yield may result from the delay of floral initiation due to change in daylength. Based on their four-year evaluation trial in Hawaii, Brewbaker, et al. (1966) noted that mainland sweet corn matured much earlier at low elevation than at higher elevations, and that the short winter daylength and warm nights of Hawaii caused a dwarfing effect on the plants. The influence of short days on leaf number has been observed by Heslop-Harrison (cited by Bunting, 1968). This worker observed that the sweet corn variety Golden Bantam receiving 8 hours of daylight had fewer leaves than those receiving 21 to 22 hours of daylight. Pendleton and Egli (1969) in the North Central States explained that increased corn yields obtained from planting in April to early May are primarily due to longer days and high radiant energy available during maturation. They observed that later plantings had less leaf surface and shorter plant height.

Andrew, et al. (1956) stated that when the same varieties are planted at successively higher latitudes they grow taller, tend to have an increased number of nodes and leaves on the main stem, and they flower later; while at successively lower latitude the reverse is true.

Corn is a plant that requires warm day and night temperatures during the growing season. In the United States the crop is seldom grown where the mean summer temperature is less than 66°F, or where the average night temperature for the three summer months falls below 55°F. Colville (1967a) stated that "perfect" weather for corn has an average daily temperature of 70° to 79°F during the summer months in the Corn Belt. The temperature during the time from emergence to tasseling is very important in determining the time of tasseling. Cool nights reduce the rapidity of growth previous to tasseling. Berger (1962) stated that for each degree the temperature averaged above 21.1°C for 60 days after planting, tasseling was speeded up by two to three days. Schrimpf (1966) indicated that increasing the daily mean temperature from 15.5°C to 18.9°C caused a reduction in days to flowering from 90 to 58.

Stanhill (1958) working with turnips at various planting dates found a negative relationship between plant weight and temperature, however, he found a positive relationship between net radiation and plant weight. Experiments conducted by Weihing (1963) showed positive relationships between temperature and growth of ryegrass. Crowder, et al. (1955) found that solar radiation was correlated with forage production during January and February, but not during November and December. Hipp, et al. (1970), planting sorghum monthly from March to September, obtained maximum yields from April, May, and June plantings which received maximum solar radiation during the fruiting stage.

Rainfall, like temperature, has a very direct bearing upon yield. Thompson (1969), and Bondavalli, et al. (1970) found that both temperature and rainfall affect corn yield. Runge (1968) on the other hand claimed that rainfall and temperature are indirect measures of the evapotranspiration requirement for a crop in a given environment. For this reason he proposed that maximum temperature and rainfall are interrelated and affect corn yield during the growing season. In his study he observed that maximum temperature and rainfall have a large effect on corn yield from 25 days before to 15 days after anthesis. He further proposed that high temperatures, maximum daily temperatures between 32.2° and 37.8°C, or 90° and 100°F can be beneficial to corn yield if moisture available to the corn plant is adequate.

Altitude affects the growth of crops indirectly as it influences temperature, precipitation, and the physical and chemical properties of the soil. An increase in elevation is accompanied by a decrease in temperature and a steady shortening of the summer season. The shortening of the season with increasing altitude has an immediate effect upon the crop in that the early autumn frosts, not falling regularly at the same date, are apt to kill the plant before the grain is mature enough for harvest. Duncan and Hesketh (1969) stated, among other things, that altitude is the chief factor governing the adaptation of maize. In turn the range in altitude within which a corn crop can be successfully grown depends largely on latitude due to temperature effects; the nearer the equator, the higher the altitude within certain limits, and the farther from the equator the lower must be the altitude. Berger (1962) presented a report on corn cultivation at various altitudes in different areas of the world. Further reviews of past works related to the influence of the environment on some agronomic characters of corn are presented by Colville (1967b), and Genter and Jones (1970). Frey (1971) stated that improvement in both the production environment and the varieties must occur hand in hand to optimize production.

Man can modify the climate surrounding the plant by changes in planting rates and patterns. Colville and McGill (1962) and Colville (1968) found that by increasing the plant population, the relative humidity within the stand was significantly increased and soil temperature decreased as much as 10°C at certain times during the day. Light intensity at one foot above the soil surface reached the low point at 20,000 plants per acre at silking.

Modification of planting patterns and plant populations has become necessary inasmuch as the reduced product of individual corn plants with increasing population is due to increased environmental stress resulting from greater competition among plants (Prine and Schroder, 1964). This is in addition to the factors which determine the effect of spacing and population on yield, as mentioned by Yao and Shaw (1964). Many comparisons involving rates of planting hybrids as well as fertility treatments for corn have been reported. Yao and Shaw (1964) summarized early studies on plant populations and, among other things, reported that the optimum stand of corn was heavier as one proceeded from lower to higher moisture supply. Dungan, et al. (1958) made a comprehensive literature review of earlier work related to corn plant population and productivity. The results of these studies were found to be inconclusive with greater variation being encountered from year to year and from location to location depending upon environmental conditions.

Lang, et al. (1956) reported a decrease in ear weight with increased population. This was confirmed by Buren and Anderson (1970) who further claimed that per cent barrenness, days to anthesis, days to silking, days from anthesis to silking, plant height, ear height and ear height-to-plant height ratio all increased as plant population increased.

Colville, et al. (1964), in a summary of earlier reports, recommended rates of planting of 12,000 to 24,000 plants per acre in humid areas and 6,000 to 12,000 plants per acre in non-irrigated semiarid regions. Stickler (1964), Holt and Timmons (1968), Vanderlip (1968), and Williams, et al. (1968), all obtained similar results. They found that under adequate moisture conditions optimum grain yields were obtained at densities between 20,000 and 24,000 plants per acre. Beer and Shrader

(1967), in a similar study, obtained maximum yields with 18,000 to 22,000 plants per acre.

Working in the Northern Great Plains, Alessi and Power (1965) found the optimum population in this area to be 10,000 plants per acre. Hight (1967), a commercial farmer in Illinois, grew corn at 28,000 plants per acre but felt that he still had to increase his planting density to reach maximum yield. Rutger and Crowder (1967) in New York, and Robertson, et al. (1968) in Florida, obtained highest average grain yields at 70,000 and 68,890 plants per hectare, respectively. Giesbrecht (1969) found that 60,000 to 75,000 plants per hectare appeared to be the optimum range of plant population for the Northern edge of the Corn Belt. In North Carolina, Nuñez and Kamprath (1969) observed that grain yields were increased as the population was increased from 34,500 plants per hectare, to 51,750. In most instances, grain yields remained the same as plant population was increased from 51,750 to 69,000 plants per hectare.

Chaudhry and Macksoud (1967) in Lebanon, and Goydani and Singh (1968) in India, reported that higher grain yields were obtained at populations of 50,000 plants per hectare. Working in another location in India, Sharma and Gupta (1968) found that a density of 60,000 plants per hectare gave higher average grain yields than 40,500 or 70,000 plants per hectare. In the Philippines, recommended rates of planting are in the range of 50,000 to 60,000 plants per hectare.[2] In Thailand the best level appeared to be 53,331 plants per hectare (Chutkaew, et al., 1971).

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[2]Personal knowledge.

The highest yield in Japan has been obtained by Iwata and Okubo (1971) at a population of 75,000 plants per hectare.

Colville (1967a) pointed out that plant populations should be designed to place about three to four acres of leaves on every acre of land. To attain this he recommended that the planting rate should not exceed 24,000 harvestable plants per acre. Nuñez and Kamprath (1969), however, found that going beyond a leaf area index (LAI) of 3.5 did not give a net increase in grain yield. This confirmed results obtained by Eik and Hanway (1966) who observed maximum corn grain yields at a LAI of about 3.3. Hunter, et al. (1970), using short-season hybrids, increased grain yield by increasing populations from 48,000 to 72,000 plants per hectare. They further claimed that the LAI value at the highest population was much lower than those usually reported and, therefore, suggested that for short-season hybrids, plant densities could still be increased to obtain maximum grain yield.

Hallauer and Hutchcroft (1967) indicated that high yields of corn grain were associated with late silking, high grain moisture at approximately physiological maturity (60 days after silking), and high grain moisture at harvest. This tends to explain the results obtained by Colville, et al. (1964) who stated that late maturing hybrids yielded higher than early maturing hybrids at any population from 12,000 to 24,000 plants per acre. On the other hand, Stringfield (1964) reported that late hybrids are better adapted to populations of 8,000 to 19,000 plants per acre, but at higher populations early hybrids performed better. The results obtained by Giesbrecht (1969), however, contradicted these earlier findings. He observed that later-maturing, taller hybrids were significantly better adapted to competition in high populations than were earlier hybrids. Kipps (1970) stated that late maturing varieties will yield more than early varieties, other things being equal. Lutz, et al. (1971) working with ten different maturing corn hybrids at three locations in Virginia observed varying yield response to populations, locations, and cropping season. They also claimed that the ratio of ears to stover was affected by population and hybrids with the latter having a more profound influence. The same results were obtained by Frey (1971) in genotype-environment studies on corn under varying plant densities.

Brown, et al. (1970), claimed that plant size has an important influence on the relationship between plant population and grain per plant and, therefore, on the optimum plant population. This implies that higher plant populations may be employed to maximize yield by developing varieties of small plants with a high grain/stover ratio, or by exposing more leaves to high light intensities through the use of plant types having vertically oriented leaves.

Army and Green (1967) stated that with a complete change in plant type, going from a tall to dwarf and with improved leaf angle and smaller ears, it is theoretically possible to produce 400 bushels of corn per acre at plant populations of about 150,000 plants per acre.

MATERIALS AND METHODS

Fifteen varieties of corn which were genetically diverse and adapted to a broad range of climates were grown at three different locations in Hawaii from May, 1970 to January, 1971.

Varieties

The varieties and their respective descriptions are as follows:

1) Hawaiian Yellow (HY)

Hawaiian Yellow was developed in Hawaii over a period of many years. It has undergone selection both by University of Hawaii and Hawaii Sugarcane Planters Association Experiment Station researchers. It is a yellow corn of both flint and dent parentage. It is particularly well adapted to the lower elevations but performs well at higher elevations during the warmer seasons.

2) Waimea Dent (WD)

Waimea Dent appears to have some flinty types in its parentage but it is predominantly of the dent type. It has been developed through natural selection in Hawaii over a period of many years. It exhibits very good resistance to *Helminthosporium turcicum*, commonly known as northern corn leaf blight. Previous studies (unpublished) have indicated that it is adapted to higher elevations and cooler conditions than Hawaiian Yellow.

3) Mayorbella (MB)

Mayorbella was introduced from Puerto Rico. This strain has also undergone many years of selection under Hawaiian conditions. It has excellent resistance to H. turcicum.

4) Helminthosporium Resistant Composite (HRC)

Helminthosporium Resistant Composite is an introduction from the Rockefeller Program in Mexico. Selections have been made from the original material and the plants vary somewhat from the original composite. It has good resistance to H. turcicum.

The above four varieties are classified as tropical types which had been either developed or selected for their performance under Hawaiian conditions. All four of these lines exhibit the polygenic type of resistance to H. turcicum which normally means that they will have fewer pustules of the organism than a line which does not have this type of resistance.

There were seven hybrids which were all the possible single cross combinations and a double cross combination of the four lines, namely:

5) WD x HRC

6) WD x MB

7) WD x HY

8) MB x HRC

9) HRC x HY

10) MB x HY

11) (HY x WD) x (MB x HRC)

Four mainland varieties were included in the experiment, namely:

12) Pioneer 3306

Pioneer 3306 is a single cross hybrid intended for the central Corn Belt. It is a medium short variety and is primarily a grain type hybrid.

13) Pioneer 3175

Pioneer 3175 is also a single cross, is a tall variety and was bred for both grain and silage uses.

14) Pioneer X304

Pioneer X304 is a new variety intended for use in the extreme southern portions of the United States and in tropical areas.

15) IXL9

IXL9 is one of Asgrow Seed Companies' new single crosses. It is primarily intended for use in the northern portion of the Corn Belt.

Locations

The locations were chosen because of their differences in elevation which, in effect, offer also a broad range of environments. The three locations and their brief descriptions are as follows:

1) Waimanalo Experiment Station, Waimanalo, Oahu.

The station, hereafter referred to as Waimanalo, is located on the windward side of the island of Oahu at an elevation of approximately 50 feet. The soil is classified as the Waialua series, very fine kaolinitic Isotypic Haplustoll. The heavy clay soil drains slowly and often can not be prepared during the wet months. Annual rainfall averages about 55 to 60 inches and is highly seasonal. About 75% of the annual rainfall occurs during the period from November to March. Annual temperatures range from 65° to 85°F and cloud cover during the summer months is usually greater than at the Kauai Branch Station.

2) Kauai Branch Station, Kapaa, Kauai.

The station, hereafter referred to as Kauai, is situated at about 600 feet elevation on the island of Kauai. The soil is classified as Halii gravelly silty clay and has fairly good drainage. The seasonal rainfall, averaging about 90 inches annually, complicates land preparation and planting operations during certain seasons of the year. Annual temperatures range from 58° to 88°F and relative humidity ranges from a minimum of 55% to a maximum of 100%.

3) Volcano Experiment Station, Volcano, Hawaii.

The station, hereafter referred to as Volcano, is located on the windward slope of Mauna Loa on the island of Hawaii at about 4,000 feet elevation. The soil is classified as a Hydrol Humic Latosol under the Puaulu series. Annual rainfall varies from 100 to 146 inches distributed more or less uniformly throughout the year. The amount of sunlight received is lower than Waimanalo and Kauai due to frequent overcast skies and high amounts of rainfall. The mean annual temperature is about 58°F and ranges between 40° to 70°F.

At Kauai and Volcano, the experiment was conducted under natural rainfall conditions while at Waimanalo, the experiment was irrigated whenever necessary.

In each location, the varieties were planted at three plant populations for each of three dates of planting.

Plant populations

1) 34,580 plants per hectare

This population was attained by growing two plants per hill spaced about 61 cm within rows nine meters long which were approximately 90 cm apart.

2) 44,460 plants per hectare

This was attained by growing two plants per hill spaced about 51 cm within rows nine meters long which were approximately 90 cm apart.

3) 54,340 plants per hectare

This was attained by growing two plants per hill spaced about 41 cm within rows nine meters long which were approximately 90 cm apart.

Dates of planting

1) May

By planting in May, the plants were exposed to gradually increasing daylength at the early stages of growth and then to decreasing daylength at maturity. This season also provided the highest temperatures and solar radiation for the year.

2) July

The July planting date exposed the plants to decreasing daylength throughout their growth period. Day and night lengths were about equal during the later stages of crop growth.

3) September

Day and night lengths were about equal at the September planting date and the daylength decreased during most of the crop growth period.

The actual dates of planting and harvesting in each location are as follows:

	Date of Planting			Date of Harvesting		
Location	I	II	III	I	II	III
Waimanalo	May 19	July 9	Sept. 24	Sept. 4	Nov. 4	Jan. 20, 1971
Kauai	May 15	July 21	Sept. 16	Oct. 10	Dec. 1	Jan. 19, 1971
Volcano	May 12	July 14	Sept. 15	Nov. 18	Jan. 20, 1971	---

Due to severe damage caused by leaf blight and very poor development of plants as a result of cold and cloudy weather, the third planting at Volcano was dropped from the experiment.

All fields were plowed and disced two to three times. At Waimanalo, where nut grass, Cyperus esculentus, was known to be a problem, "Sutan" was applied at the rate of 1.5 kg per hectare for the control of grass weeds. Furrows approximately 90 cm apart were cut after the last harrowing.

Nitrogen, phosphorous and potassium were applied uniformly to all fields in bands at planting time at the rate of 112 kg N, 124 kg P, and 186 kg K per hectare. Nitrogen and phosphorus were applied in the form of dimammonium phosphate (18-46-0) and potassium in the form of muriate of potash (0-0-60). Additional nitrogen, at the rate of 112 kg per hectare in the form of urea, was side-dressed about four weeks after planting.

At each location and date of planting, the experiment was laid out in a split-plot design with four replications. Plant population was assigned as the main plot and varieties, randomized within a population, were assigned as sub-plots. Planting was done by hand and marked guides were used to ensure uniform plant spacing. Each entry was planted in single-row plots nine meters long. Rows were spaced 90 cm apart and two plants per hill were maintained at all planting densities. Three seeds were sown per hill and later thinned to two when the plants were about 12 to 16 cm high. Immediately after sowing, a mixture of "Atrazine" and "Lasso," at the rate of 1.5 and 1 kg per hectare, respectively, was applied over the area for the control of broadleaved weeds and other grass species.

"Cygon" and "Malathion" were applied weekly at the rate of two to three lbs per 100 gallons of water for the control of leafhopper, Peregrinus maidis, Ashmead, the insect vector of corn stripe mosaic. At Waimanalo, adequate soil moisture levels were maintained with supplemental sprinkler irrigation.

Dates of tasseling and silking, disease and insect problems, plant height, ear height and amount of lodging were collected prior to harvesting. A variety was considered at the tasseling or silking stage when at least 50 per cent of the plants in a plot were tasseling or silking. Plant and ear heights were measured from the soil level to the tip of the tassel and to the upper ear node about two weeks before harvesting. All plants in the plot, except the two end-hills, were harvested. Data were collected on 28, 34 and 40 plants per plot at the 34,580, 44,460 and 54,340 plant populations, respectively. Where some plants in a plot were missing, the actual number of plants harvested was used to obtain the area harvested and this in turn was converted to a per-plot basis. The yields per plot were converted to yields per hectare and statistical analyses were performed on the converted data.

The entire plot harvested was weighed for both ear and stover green weight yields. Two- to three-kg samples of stover were used for moisture determinations. Ten ears were randomly selected for moisture determinations and for ear length. The moisture samples were dried in an oven at 150°F for 72 hours or until the samples had reached constant weight. The yield data presented are expressed on a dry weight basis.

The computation facilities of the University of Hawaii Statistical and Computing Center were used for the analyses of the data. Data were analyzed as a split-plot for each planting date within each location. The form of the analysis of variance for the individual dates of planting within a location was as follows:

Source	d.f.
Replication (a)	(a-1)
Populations (b)	(b-1)
Pop. x Rep.	(a-1)(b-1)
Varieties (c)	(c-1)
Var. x Pop.	(c-1)(b-1)
Var. x Rep.	(c-1)(a-1)
Var. x Pop. x Rep.	(c-1)(b-1)(a-1)

Combined analyses were also performed in the following manner:

1) Within location across dates of planting and plant populations.

   A split-plot analysis was performed with date of planting as the main plot, population as the subplot and varieties as the sub-subplot. The form of analysis of variance for within location over dates of planting and plant populations was as follows:

Source	d.f.
Replication (a)	(a-1)
Dates (b)	(b-1)
Date x Rep.	(b-1)(a-1)
Populations (c)	(c-1)
Pop. x Date	(c-1)(b-1)
Pop. x Rep.	(c-1)(a-1)
Pop. x Date x Rep.	(c-1)(b-1)(a-1)
Varieties (d)	(d-1)
Var. x Date	(d-1)(b-1)
Var. x Pop.	(d-1)(c-1)
Var. x Pop. x Date	(d-1)(c-1)(b-1)
Var. x Rep.	(d-1)(a-1)
Var. x Date x Rep.	(d-1)(b-1)(a-1)
Var. x Pop. x Rep.	(d-1)(c-1)(a-1)
Var. x Pop. x Date x Rep.	(d-1)(c-1)(b-1)(a-1)

2) Across dates of planting, locations and plant populations.

A split-split-plot analysis was performed assigning date of planting as the main plot, location as the subplot, population as the sub-subplot and varieties as the sub-sub-subplot. The form of analysis of variance over dates of planting, locations and populations was as follows:

Source	d.f.
Replication (a)	(a-1)
Dates (b)	(b-1)
Date x Rep.	(b-1)(a-1)
Locations (c)	(c-1)
Loc. x Date	(c-1)(b-1)
Loc. x Rep.	(c-1)(a-1)
Loc. x Date x Rep.	(c-1)(b-1)(a-1)
Populations (d)	(d-1)
Pop. x Date	(d-1)(b-1)
Pop. x Loc.	(d-1)(c-1)
Pop. x Loc. x Dates	(d-1)(c-1)(b-1)
Pop. x Rep.	(d-1)(a-1)
Pop. x Dates x Rep.	(d-1)(b-1)(a-1)
Pop. x Loc. x Rep.	(d-1)(c-1)(a-1)
Pop. x Loc. x Dates x Rep.	(d-1)(c-1)(b-1)(a-1)
Varieties (e)	(e-1)
Var. x Date	(e-1)(b-1)
Var. x Loc.	(e-1)(c-1)
Var. x Loc. x Date	(e-1)(c-1)(b-1)
Var. x Pop.	(e-1)(d-1)
Var. x Pop. x Date	(e-1)(e-1)(b-1)
Var. x Pop. x Loc.	(e-1)(d-1)(c-1)
Var. x Pop. x Loc. x Date	(e-1)(d-1)(c-1)(b-1)
Var. x Rep.	(e-1)(a-1)
Var. x Date x Rep.	(e-1)(b-1)(a-1)
Var. x Loc. x Rep.	(e-1)(c-1)(a-1)
Var. x Loc. x Date x Rep.	(e-1)(c-1)(b-1)(a-1)
Var. x Pop. x Rep.	(e-1)(d-1)(a-1)
Var. x Pop. x Date x Rep.	(e-1)(d-1)(b-1)(a-1)
Var. x Pop. x Loc. x Rep.	(e-1)(d-1)(c-1)(a-1)
Var. x Pop. x Loc. x Date x Rep.	(e-1)(d-1)(c-1)(b-1)(a-1)

Complete data summaries are presented in Appendix Tables 8 through 40. Results of the analyses of variance including information on the error terms used to test the various main effects and interactions are presented in Appendix Tables 51 through 58. Correlation matrices for each character measured for each date of planting within location and for dates of planting averaged over locations are presented in Appendix Tables 41 through 50.

The data reported in the results section and in Appendix Tables 8 through 40 were interpreted only at the five per cent probability level.

At Waimanalo, yield data were not collected for the following varieties: Pioneer 3306, Pioneer 3175 and HRC from the second planting and in addition to these three, yield data were not collected for the variety IXL9 from the third planting because these varieties were completely eliminated by mosaic. At Kauai, Pioneer 3175, Pioneer 3306 and IXL9 were eliminated from the second planting and the same varieties plus HRC were eliminated in the third planting for the same reason. As a result of this uneven number of entries among seasons in a location, combined analyses were based on 11 varieties common to all dates of planting and locations (Appendix Tables 52, 54 and 56 through 58). Likewise, in the absence of a third harvest at Volcano, a combined analysis across all three locations at only two dates of planting (Appendix Table 57) was performed. A separate analysis across two locations--Waimanalo and Kauai--at three dates of planting was performed (Appendix Table 58).

Monthly rainfall and average monthly maximum and minimum temperatures for the period May, 1970 to January, 1971 for each location are presented in Appendix Table 59. The average monthly maximum and minimum relative humidities for Kauai and Volcano and average monthly solar radiation for Volcano are also presented in Appendix Table 59.

RESULTS

A. Ear yield

No records were obtained from the Volcano Station for the September planting date due to an extremely heavy infestation of *H. turcicum* and poor growing conditions.

1) Effect of dates of planting, locations and their interactions on ear yield.

Detailed summary tables for ear yield are in Appendix Tables 8 through 12. Ear yields at the different locations averaged over dates of planting are presented in Appendix Tables 11 and 12. Average ear yield at each of the locations for each planting date are presented in Figure 1. Highest yields were obtained from the May planting date followed by the July and September planting dates. Yields from the July and September planting dates over locations declined by nearly one-half that obtained from the May planting date.

For the May planting date, Kauai had the highest yields, followed by Volcano and Waimanalo. For the July planting date, Waimanalo had the highest yields, followed by Kauai and Volcano. For the September planting date, there was little difference between Waimanalo and Kauai, although Kauai had higher yields.

Ear yield results indicate that planting in May at any of the three locations provided the crop with the best of environmental conditions for growth and maturation. During the period from May to September, daylength is at a maximum and

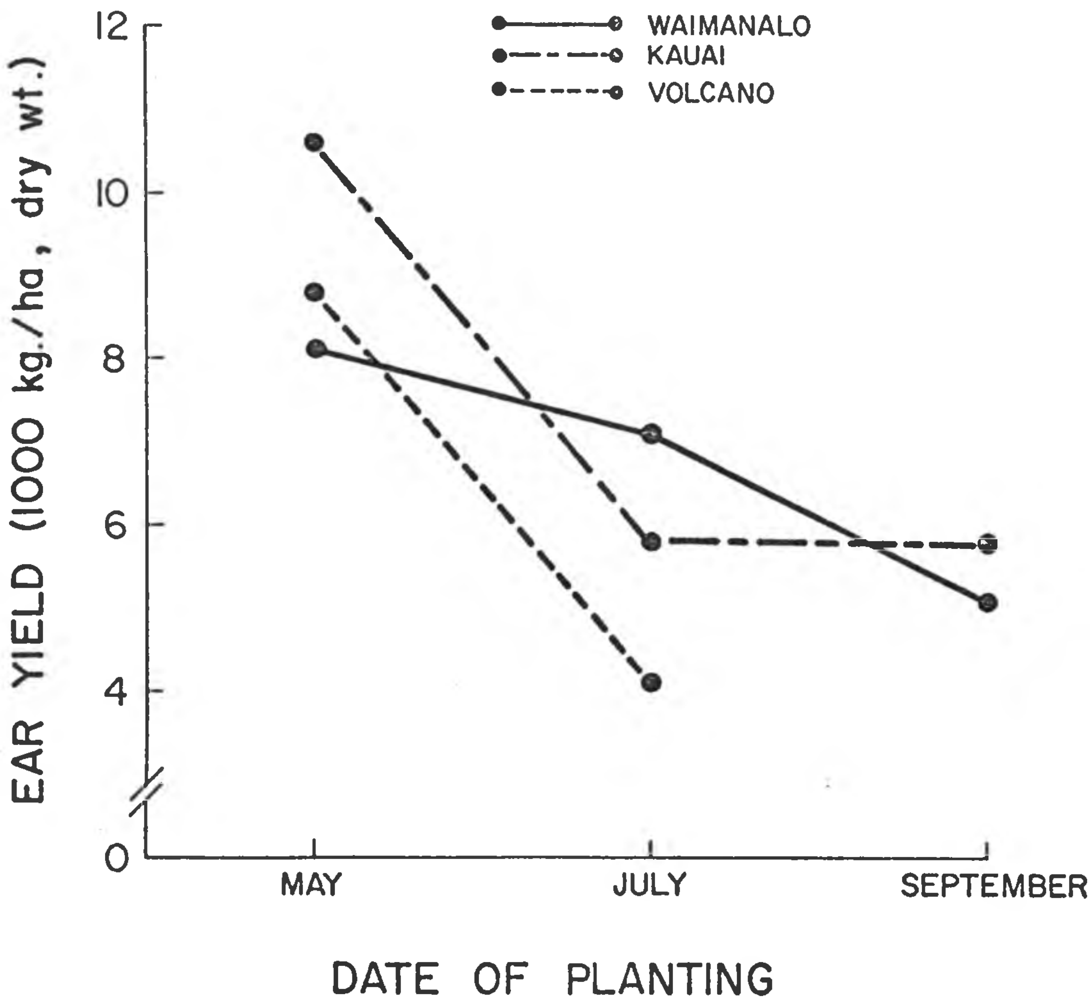

Figure 1. Effect of Date of Planting on
Ear Yield of Corn at Three Locations

solar radiation is greatest during this period.

2) Effect of plant populations and their interaction with dates of planting and locations on ear yield.

The overall effects of plant populations with dates of planting and locations on ear yield are presented in Table 1. There was a significant increase in ear yield as plant populations increased from 34,580 plants/ha to 44,460 plants/ha. This increase in yield was similar for the May and July planting dates averaged over all locations and also for the May, July and September planting dates averaged over Waimanalo and Kauai.

At Waimanalo, ear yields increased as plant populations increased from the lowest plant population to the highest. Highest yields were obtained from the May planting date.

At Kauai, for the May planting date, highest ear yields were obtained from the lowest plant population and ear yields declined as plant population increased. For the July planting date, the middle population gave the highest ear yield and for the September planting date, the highest plant population produced the highest ear yields.

At Volcano, for the May planting date the middle plant population produced the highest ear yields. For the July planting date, there was very little difference in ear yield among plant populations.

Table 1. Ear Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population, Location and Date of Planting

	May Planting Plant Populations			May Means	July Planting Plant Populations			July Means	September Planting Plant Populations			September Means	Means over Dates of Planting Plant per hectare			Location Means
	34,580	44,460	54,340		34,580	44,460	54,340		34,580	44,460	54,340		34,580	44,460	54,340	
Waimanalo	7,471	8,039	8,902	8,069	6,118	6,666	8,200	7,085	4,331	4,901	5,461	4,898	5,945	6,554	7,552	6,684
Kauai	11,120	10,467	8,999	10,672	4,840	6,439	6,056	5,741	4,977	5,258	5,588	5,229	7,090	7,612	7,010	7,214
Volcano	8,950	9,840	9,784	9,541	4,021	3,916	3,950	3,962	-	-	-	-	6,652	7,103	7,166	6,973
Means	9,296	9,779	9,458	9,511	5,070	5,736	6,174	5,660	4,654	5,080	5,562	5,098	6,562	7,089	7,242	6,956

3) Effect of varieties and their interactions with dates of planting, locations and plant populations on ear yield.

Differences in ear yield were observed among varieties (Appendix Tables 11 and 12). The response to change in growing season was similar among the varieties. Highest ear yields were obtained at the May planting date. Over all dates of planting and locations the highest yielding varieties were Pioneer X304, HY, the double cross hybrid (HY x WD) x (MB x HRC), and the single cross WD x HRC. WD, MB and their single cross WD x MB consistently produced lower ear yield than the other varieties. The remaining single crosses were intermediate in ear yield.

There was a significant[3] variety by location interaction. Interactions of varieties with locations over dates of planting for each ear yield are presented in Appendix Tables 11 and 12. For example, Pioneer X304 was highest in yield at Kauai, HY was highest at Waimanalo, and both performed poorly at Volcano.

Although the interaction of varieties by dates of planting by location was not significant, the yields of varieties at the different dates of planting for each location are presented in Figures 2a, 2b and 2c. The interaction of varieties by populations by locations are significant. The yield for the varieties at the three populations at Waimanalo, Kauai and

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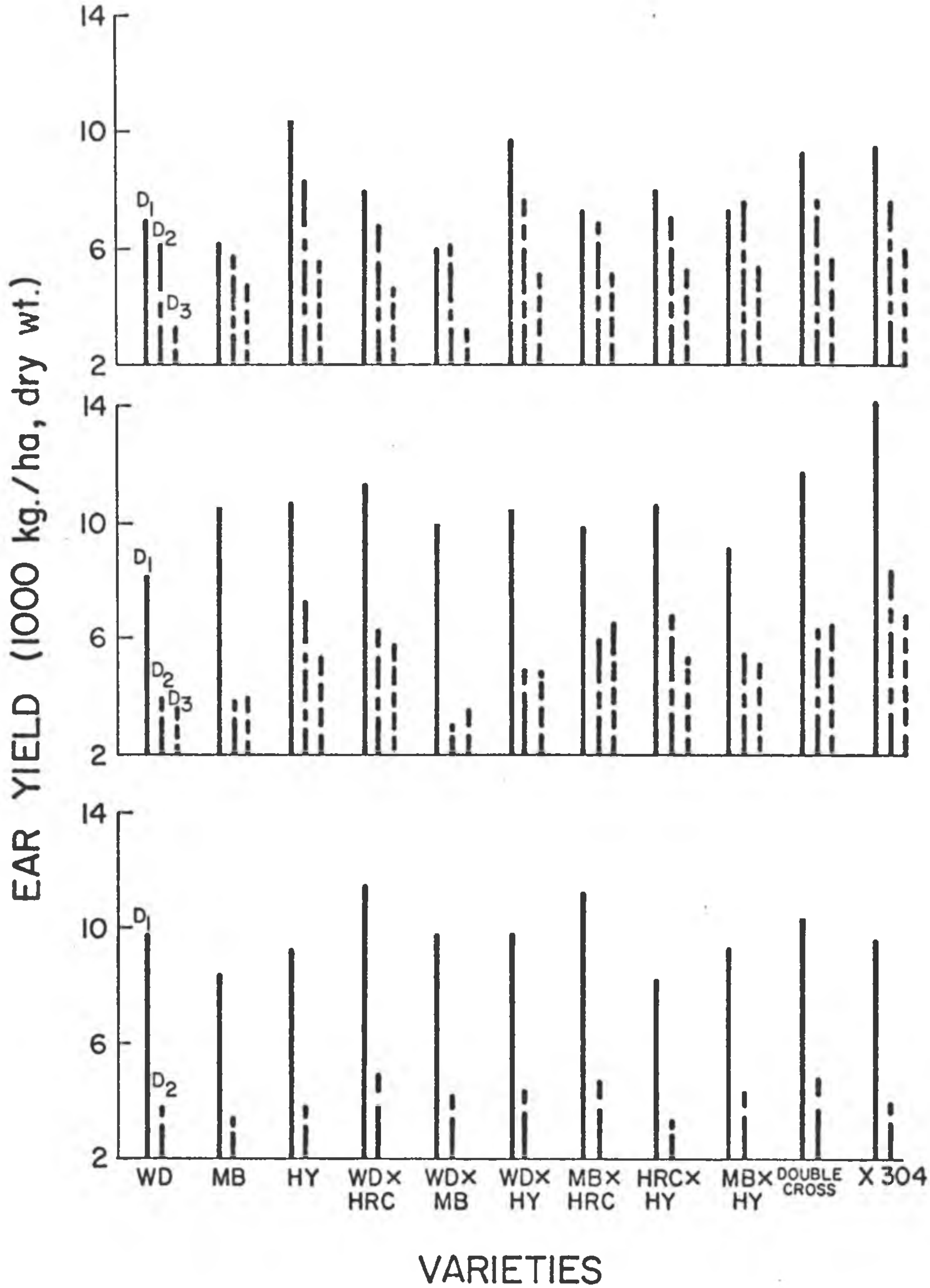
[3]The results were statistically significant at the 5 per cent probability level. The word 'significant' as used throughout the result section implies statistical significance at the 5 per cent level.

Figure 2a. Effect of Varieties on Ear Yield of Corn at Three Dates of Planting at Waimanalo (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 2b. Effect of Varieties on Ear Yield of Corn at Three Dates of Planting at Kauai (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 2c. Effect of Varieties on Ear Yield of Corn at Two Dates of Planting at Volcano (D1=May Planting and D2=July Planting).


EAR YIELD (1000 kg./ha, dry wt.)
14
10
6
2
D1
D2
D3
WD
MB
HY
WD× HRC
WD× MB
WD× HY
MB× HRC
HRC× HY
MB× HY
DOUBLE CROSS
X 304
VARIETIES

Volcano are presented in Figures 3a, 3b and 3c. The variety HY performed well over all populations at Waimanalo, X304 performed best over all populations at Kauai while some of the single crosses produced the best yields at Volcano.

WD and MB were similar in yield at Waimanalo and Volcano, but their single cross, WD x MB, when averaged over date of planting gave superior yields when grown at Volcano. On Kauai, yields of MB, WD x HRC, WD x MB, HRC x HY, the double cross and Pioneer X304 were significantly higher than their corresponding yields at the other locations. MB x HRC yielded the same at Kauai and Volcano and MB x HY yielded the same at Waimanalo and Kauai.

Although HRC failed to survive in the July and September plantings in all locations, it performed well in the May planting at all locations.

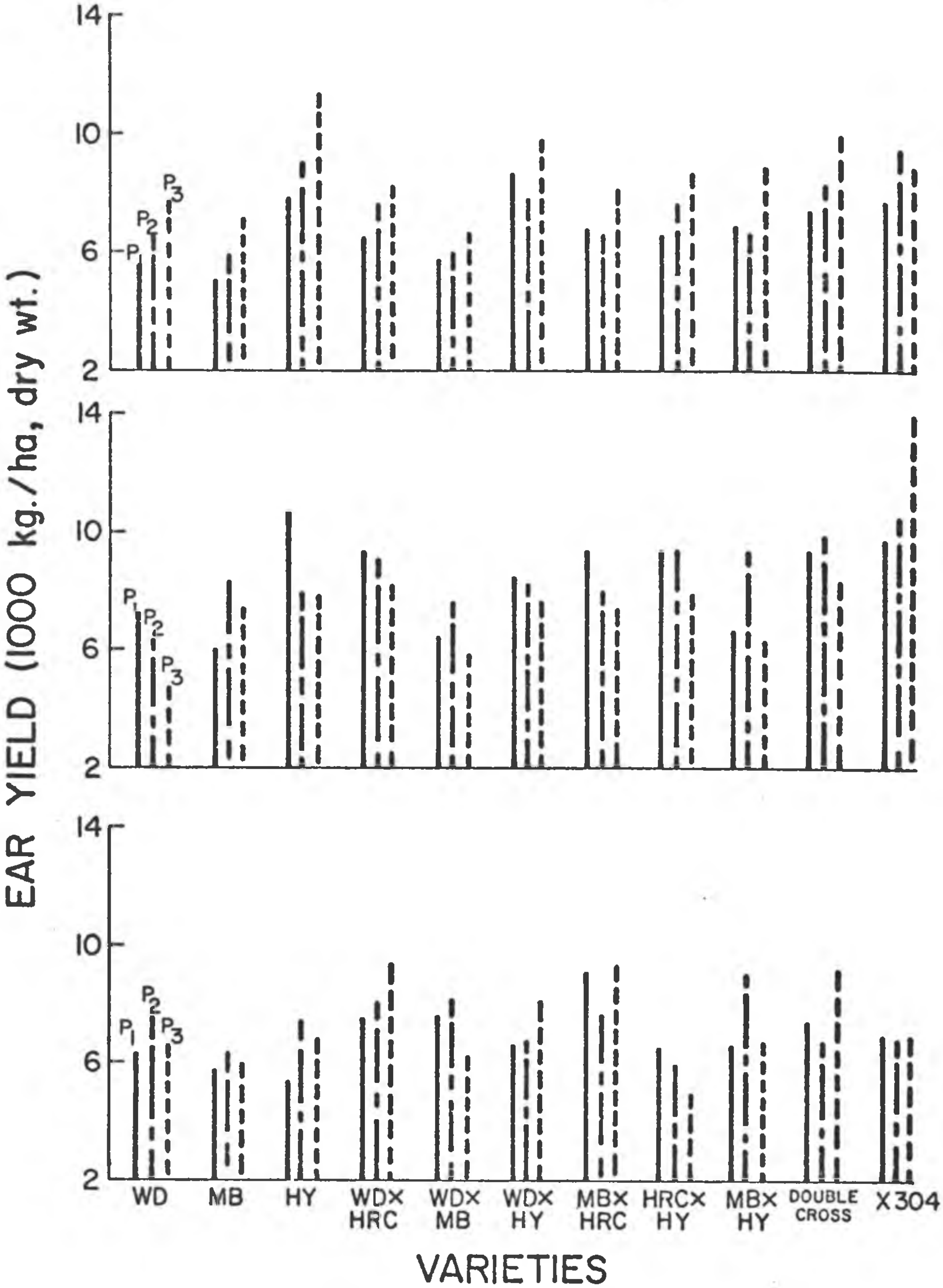
Among the crosses, WD x HY was high yielding at Waimanalo. Ear yields of WD x MB were consistently low at Waimanalo and Kauai and were similar to the other single crosses at Volcano. The double cross hybrid was the second highest yielding variety at Kauai and the third highest at Waimanalo and Volcano.

Pioneer X304 was significantly higher in yield than the other mainland hybrids when planted in May at Kauai. No significant differences in yields were observed among the mainland hybrids at Waimanalo and Volcano. In all locations, the mainland hybrids were comparable to the local varieties and their hybrids.

Figure 3a. Effect of Varieties Grown at Three Plant Populations on Ear Yield of Corn at Waimanalo (P1=34,580 plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha.

Figure 3b. Effect of Varieties Grown at Three Plant Populations on Ear Yield of Corn at Kauai (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).

Figure 3c. Effect of Varieties Grown at Three Plant Populations on Ear Yield of Corn at Volcano (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).



EAR YIELD (1000 kg./ha, dry wt.)
14
10
6
2
P1
P2
P3
WD
MB
HY
WDx HRC
WDx MB
WDx HY
MBx HRC
HRCx HY
MBx HY
DOUBLE CROSS
X304
VARIETIES

For all varieties grown at Waimanalo except Pioneer X304, increasing plant population produced increased yields. This lack of a yield increase for Pioneer X304 is attributed to the increased mutual shading which resulted when this relatively short hybrid was grown together with taller varieties. In the last two plantings at Waimanalo, when the varieties generally did not grow as tall as in the first planting, yields of Pioneer X304 were relatively higher, in fact they were highest in September at the highest plant population (Appendix Table 8).

At Kauai, Pioneer X304 yielded about the same at the two lower plant populations but when the population was increased to 54,340 plants/ha there was a large increase in ear yield.

At Volcano, little change in yield was obtained for WD x HRC and the double cross hybrid when plant populations were increased from 34,580 to 44,460 plants/ha but large increases in yields were obtained when plant populations were further increased to 54,340 plants/ha. WD x MB and HRC x HY showed a negative yield response to increasing plant population. In contrast, WD x HRC and WD x HY gave increased yields as the plant populations were increased.

B. Stover yield

1) Effect of dates of planting, locations and their interactions on stover yield.

Detailed summary tables for stover yields are presented in the appendix (Tables 13 through 17). The average effects of dates of planting within locations are presented in Figure 4. Like ear yields, highest stover yields were obtained from the May planting. Stover yields were reduced significantly when the crop was planted in July and September. The degree of stover yield response, however, varied for the different locations. There was a decline in yield in all three locations as planting was delayed from May to July. The magnitude of stover yield decline at Kauai was less between the July and September plantings than the stover yield decline between the May and July plantings. As a result, highest stover yields among the three locations were obtained from Waimanalo with the May and July plantings, and from Kauai with the September planting. Consistently lower stover yields were obtained at Volcano from the first two dates of planting.

2) Effect of plant populations and their interactions with dates of planting and locations on stover yield.

The overall effects of plant populations with dates of planting and locations are presented in Table 2. Varying responses in stover yield were noted at the different locations upon increasing plant population from 34,580 to 54,340 plants/ha. The highest stover yield was obtained at Waimanalo when corn was grown at the highest plant population. Comparable stover yields were obtained at Waimanalo and Kauai for the low and medium plant populations. Stover yields at Volcano were consistently lower than the other two locations at all populations.

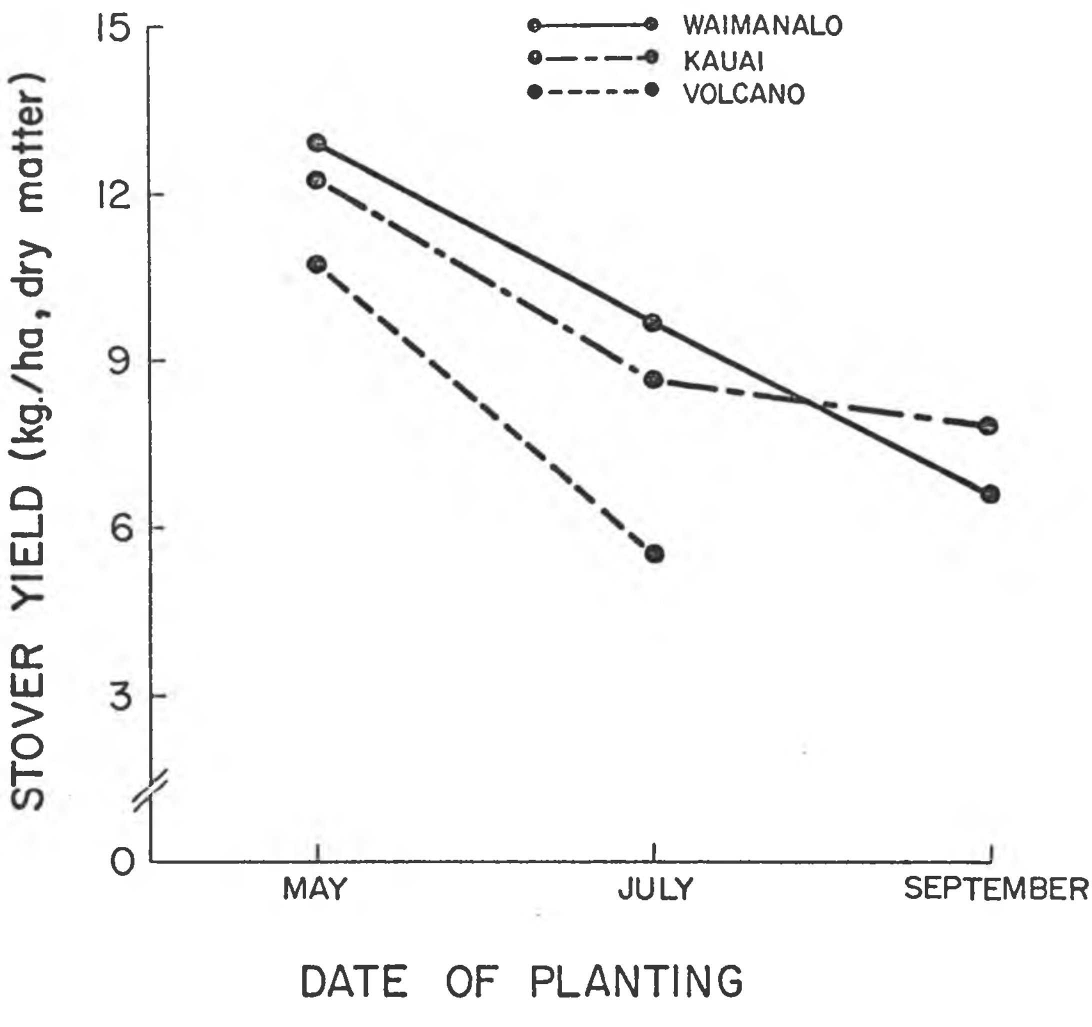


Figure 4. Effect of Date of Planting on Stover Yield of Corn at Three Locations

Table 2. Stover Yield of Corn (kg/ha,dry weight) as Influenced by Plant Population, Location and Date of Planting

	May Planting			May	July Planting			July	September Planting			September	Means over Dates of Planting			Location
	Plants per hectare				Plants per hectare				Plants per hectare				Plants per hectare			
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
Waimanalo	11,282	11,520	13,887	12,949	9,591	9,838	12,387	10,926	5,477	6,296	7,447	6,407	9,139	9,554	11,588	10,094
Kauai	11,864	11,182	9,707	12,299	7,907	9,978	8,810	8,815	7,514	7,194	8,504	7,689	9,501	10,064	9,330	9,601
Volcano	9,190	10,791	11,210	10,397	4,428	5,041	5,944	5,137	-	-	-	-	6,954	8,336	9,309	8,199
Means	10,778	11,164	11,601	33,543	7,436	8,487	9,372	8,432	6,496	6,745	7,998	7,080	8,531	9,318	10,075	9,298

The degree of response to dates of planting at the three locations varied with plant population. Increased stover yields were obtained from Waimanalo and Volcano as plant populations were increased from 34,580 to 54,460 plants/ha. At Waimanalo, the seasonal response of stover yield was influenced significantly by plant population. Greater stover yields were obtained in the May and July plantings as plant populations were increased from 44,460 to 54,340 plants/ha. Similar responses were observed at Volcano.

In contrast, at Kauai no significant increase in stover yield was noted with increasing plant populations and in the May planting, stover yield declined significantly with increasing plant populations.

3) Effect of varieties and their interactions with dates of planting, locations and plant populations on stover yields.

Variations in stover yields were observed among varieties over all dates of planting and locations. There was a significant variety by season interaction. In the May planting, highest stover yields were obtained from WD x HRC while the highest stover yields in the July planting were obtained from WD and WD x HRC. The highest stover yields in the September planting were obtained from WD x HRC, WD and MB x HRC.

The interaction of variety with location was significant. At Kauai, for example, significantly higher stover yields were obtained from WD. At Waimanalo, highest stover yields were obtained from WD x HRC, WD x HY, MB x HRC, HRC x HY and from the double cross hybrid. Highest stover yields at Volcano were obtained from WD, WD x HRC, MB x HRC and from the double cross hybrid.

At Waimanalo and Volcano, a decrease in yield was observed for all varieties as the planting was delayed (Figures 5a and 5c). At Kauai, where the variety by season interaction was significant, highest stover yields were obtained from WD at all planting dates (Figure 5b). Stover yields of WD x HRC and MB x HRC were higher at the September planting than at the July planting.

Over all dates of planting and locations, highest stover yields were obtained from WD. Within the same date of planting, none of the hybrids yielded higher than WD. Relatively high stover yields were also obtained from WD x HRC over all dates of planting and locations. With the exception of MB x HY, stover yields of the single crosses were higher than either HY or MB over all locations for the July and September plantings. The stover yields of MB x HY were lowest among the single crosses at these two dates of planting. Stover yield of Pioneer X304 which was developed for high ear yield was generally low over all dates of planting and locations.

The stover yields of the varieties at the three populations were similar at the same location but varied among locations. The interactions of varieties with plant populations at Waimanalo, Kauai and Volcano are presented in Figures 6a, 6b and 6c. At Waimanalo large stover yield increases were obtained

Figure 5a. Effect of Varieties on Stover Yield of Corn at Three Dates of Planting at Waimanalo (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 5b. Effect of Varieties on Stover Yield of Corn at Three Dates of Planting at Kauai (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 5c. Effect of Varieties on Stover Yield of Corn at Two Dates of Planting at Volcano (D1=May Planting and D2=July Planting).

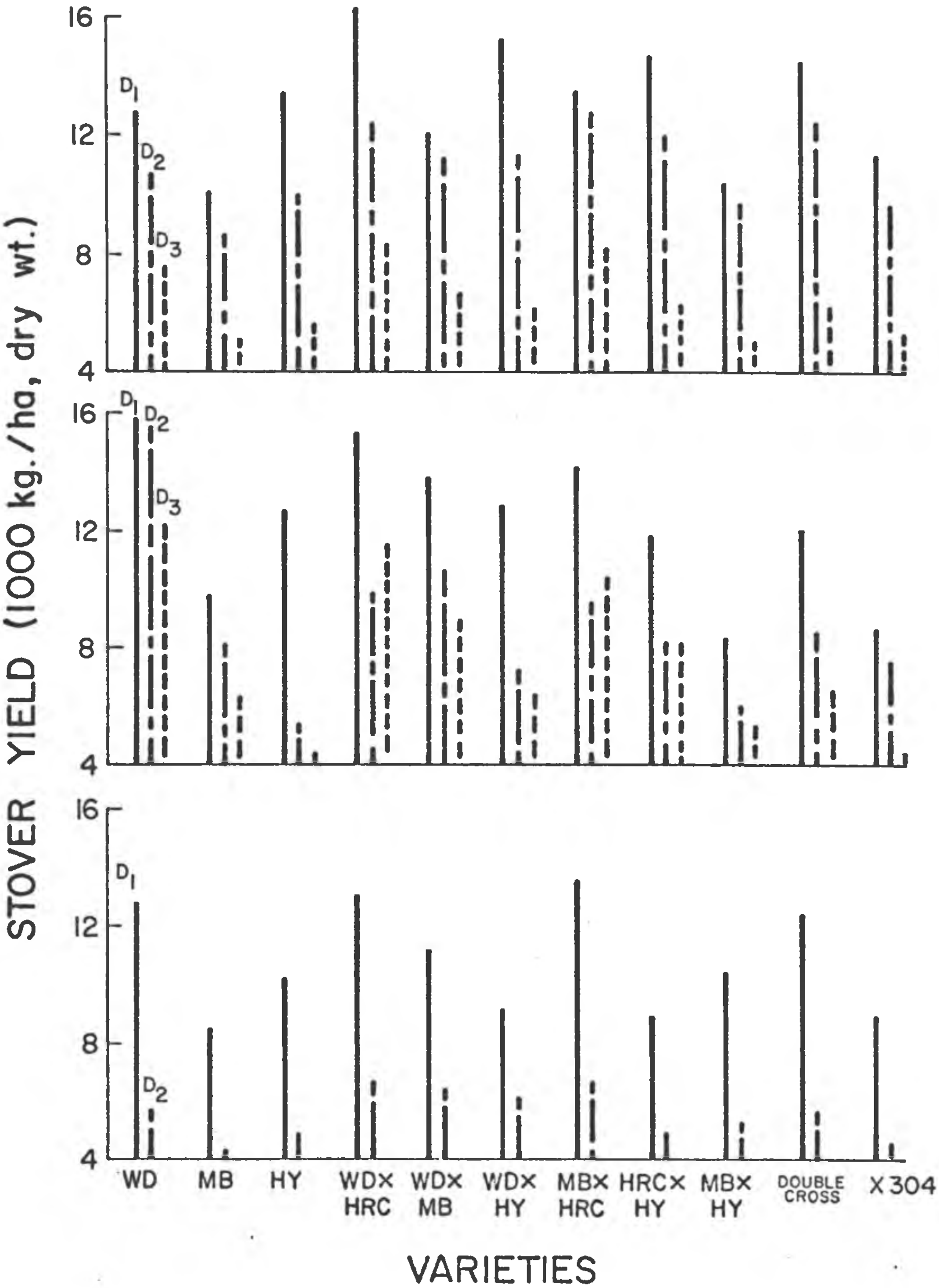
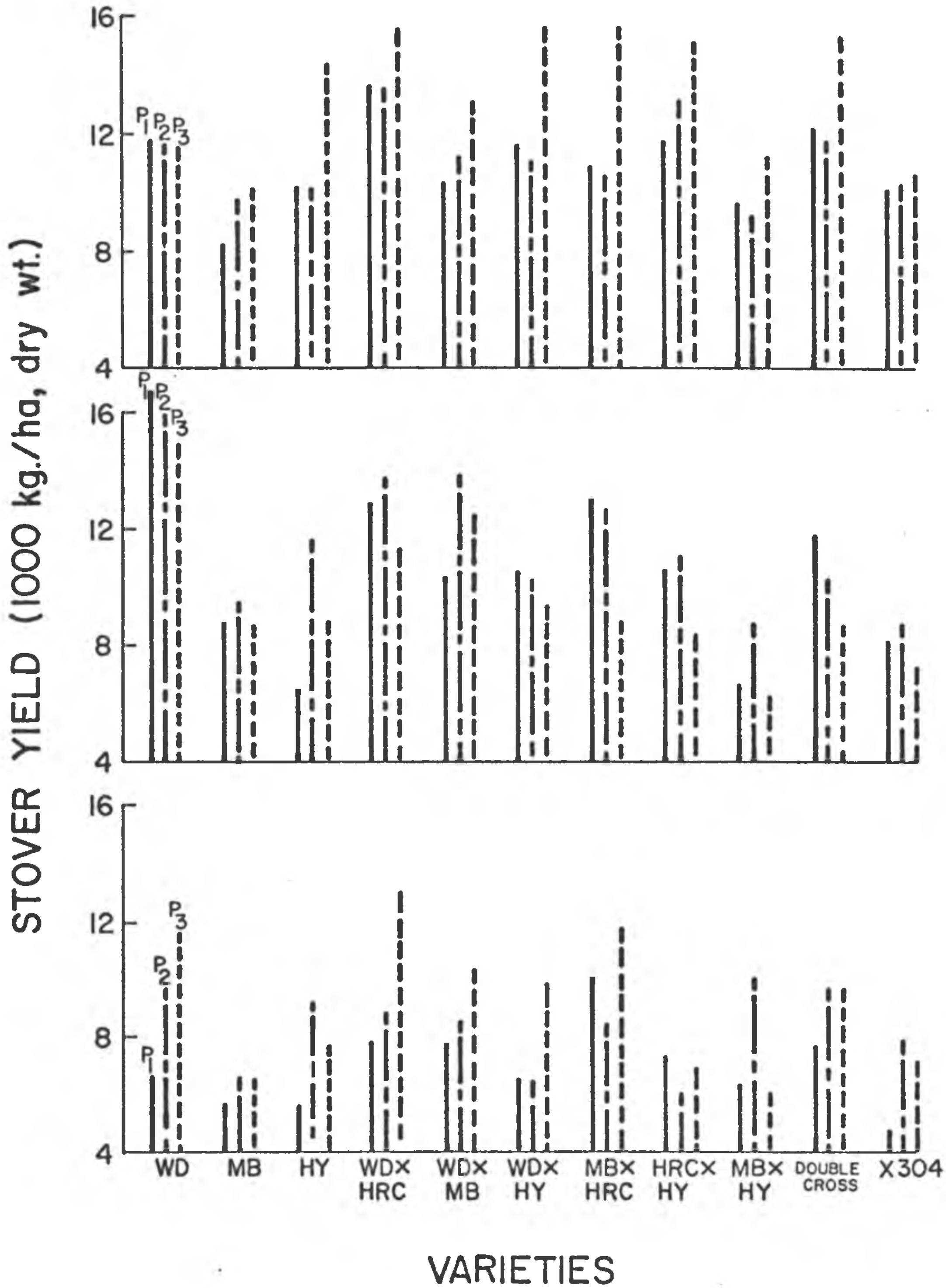

STOVER YIELD (1000 kg./ha, dry wt.)
16
12
8
4
D1
D2
D3
WD
MB
HY
WDx HRC
WDx MB
WDx HY
MBx HRC
HRCx HY
MBx HY
DOUBLE CROSS
X304
VARIETIES

Figure 6a. Effect of Varieties Grown at Three Plant Populations on Stover Yield of Corn at Waimanalo (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 plants/ha).

Figure 6b. Effect of Varieties Grown at Three Plant Populations on Stover Yield of Corn at Kauai (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).

Figure 6c. Effect of Varieties Grown at Three Plant Populations on Stover Yield of Corn at Volcano (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).


STOVER YIELD (1000 kg./ha, dry wt.)
16
12
8
4
P1 P2 P3
WD
MB
HY
WD× HRC
WD× MB
WD× HY
MB× HRC
HRC× HY
MB× HY
DOUBLE CROSS
X304
VARIETIES

from all varieties at the highest plant population with the exception of Pioneer X304 (Figure 6a). The highest stover yields were obtained from MB x HRC, WD x HY and WD x HRC at the highest plant population. MB and MB x HY consistently had low stover yields at all plant populations. Very little response was obtained from Pioneer X304 with increasing plant populations. The stover yield of WD was comparable with the crosses.

At Kauai (Figure 6b), the highest stover yields were obtained from WD averaged over all plant populations. As plant populations were increased from 34,580 to 44,460 plants/ha, stover yields of MB, HY, WD x MB, MB x HY and Pioneer X304 increased. Further increasing plant population to 54,340 plants/ha resulted in lower stover yields for these varieties.

A different trend was observed at Volcano (Figure 6c). Stover yields increased with increasing plant populations but the degree of response varied among varieties. The highest stover yield was obtained from WD x HRC at the highest plant population. There were no significant differences in stover yields among varieties at the middle population.

C. Ear length

1) Effect of dates of planting, locations and their interactions on ear length.

Detailed summary tables for ear length are presented in the appendix (Tables 18 through 22). Ear length varied with dates of planting and locations (Figure 7). Ears were longest

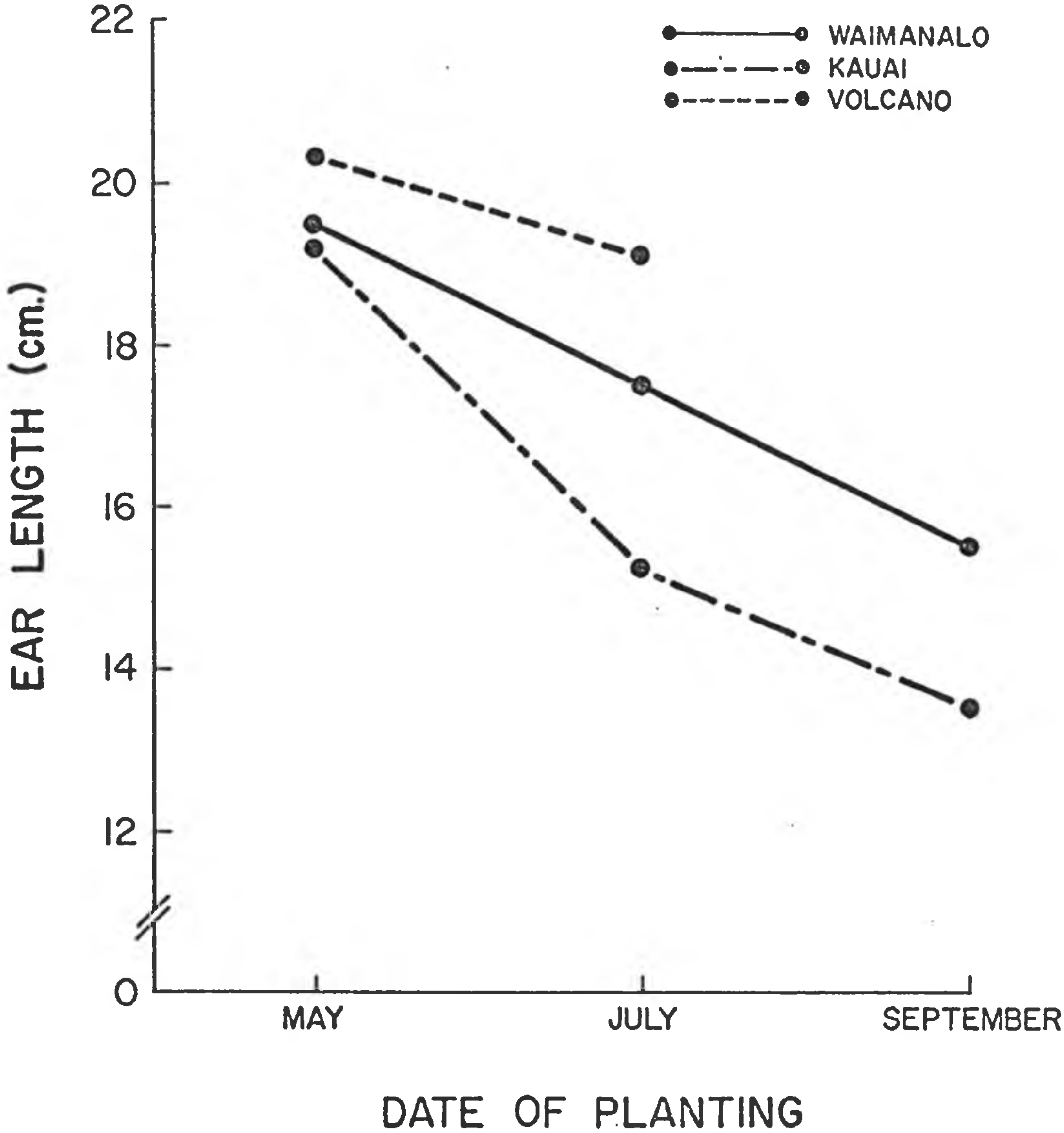


Figure 7. Effect of Date of Planting on Ear Length of Corn at Three Locations.

in the May planting and were shorter in the July and September plantings at all locations. There was a significant location by date of planting interaction. The longest ears were obtained at Volcano for the May and July planting dates. Yet, it was observed that ear yield was lowest at Volcano for the July planting date. The ear length decreased at Kauai as the planting date was delayed from May to July to September.

2) Effect of plant populations and their interactions with dates of planting and locations on ear length.

The effects of plant population, date of planting and location on ear length are presented in Table 3. Ear length was significantly reduced as plant population was increased. There was a significant population by date of planting interaction. The greatest reduction in ear length, averaged over all locations, was observed for the May planting as plant populations were increased from 44,460 to 54,340 plants/ha. Ear length was not significantly affected by plant population at the July planting date. In the September planting, ear length was unaffected by plant population at Waimanalo and Kauai. No data were obtained at Volcano for the September planting.

The interaction of plant population with location was significant. At Waimanalo at the May planting date although ear length was reduced greatly when plant population was increased from 44,460 to 54,340 plants/ha, ear yields were highest at the highest plant population (Figure 3a). The increasing numbers of ears harvested per hectare more than

Table 3. Ear Length of Corn (cm) as Influenced by Plant Population, Location and Date of Planting

	May Planting				July Planting				September Planting				Means over Dates of Planting			
	Plants per hectare			May	Plants per hectare			July	Plants per hectare			September	Plants per hectare			Location
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
Waimanalo	19.43	20.30	18.77	19.50	18.87	16.75	16.78	17.47	15.86	15.70	15.15	15.57	18.05	17.58	16.90	17.51
Kauai	20.01	19.85	16.85	19.23	14.88	15.77	15.07	15.24	13.90	13.78	12.71	13.46	16.52	16.47	14.88	17.24
Volcano	20.01	20.47	20.15	20.21	19.43	19.15	18.99	19.19	-	-	-	-	19.72	19.81	19.57	19.75
Means	19.81	20.20	18.59	19.53	17.74	17.19	17.04	17.32	14.88	14.74	13.93	14.51	18.09	17.95	17.11	17.71

compensated for the smaller ear size.

At Kauai, ear length was reduced sufficiently at the highest population such that the higher numbers of plants failed to compensate for small ears. The result was a lower yield for the May planting at the highest plant population. In the July planting, ear length was similar at all plant populations.

At Volcano, ear length was similar at all plant populations at each date of planting.

3) Effect of varieties and their interactions with dates of planting, locations and plant populations on ear length.

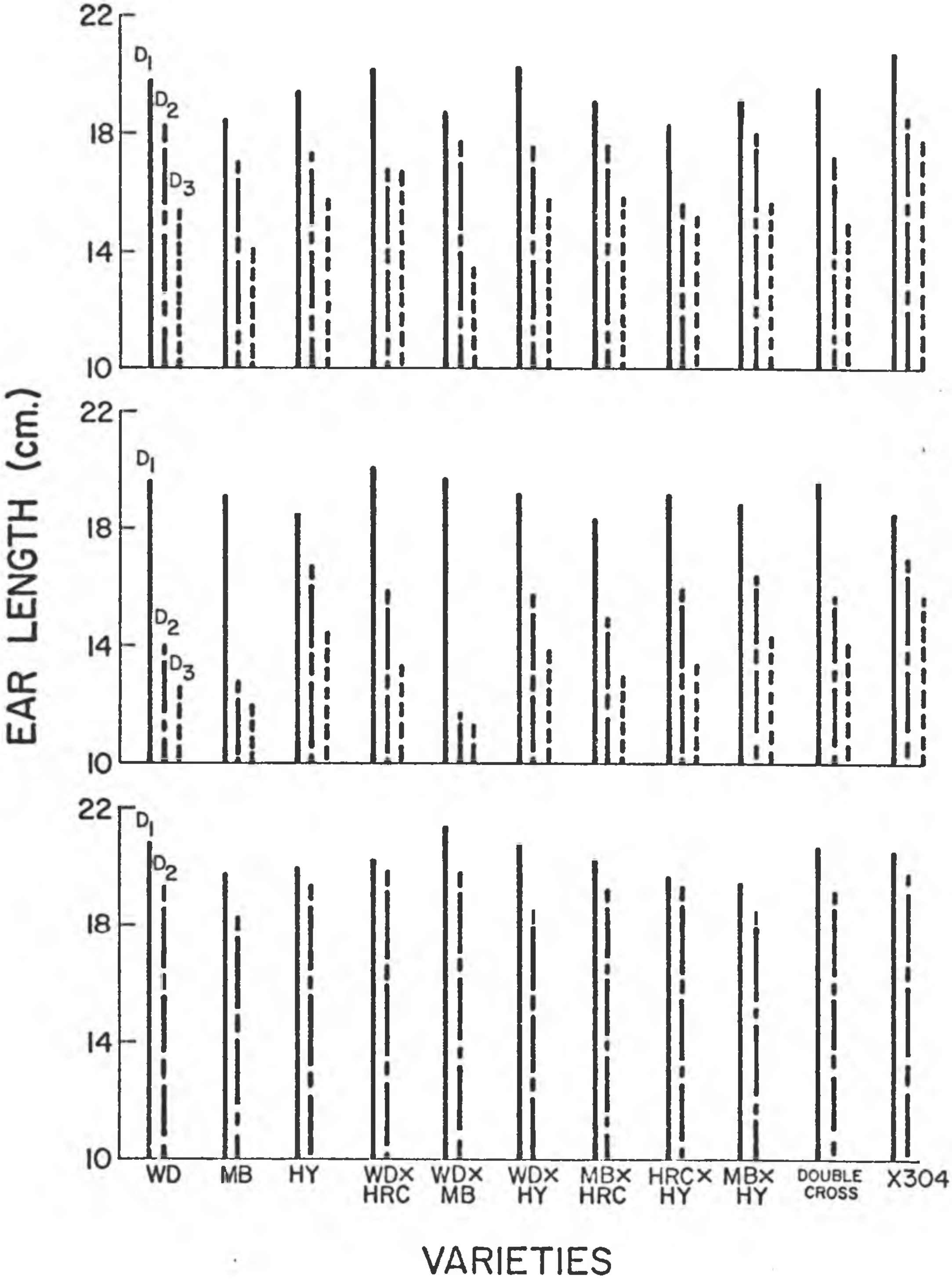
Differences in ear length were observed among varieties at all dates of planting and in all locations (Figures 8a, 8b and 8c). In the May planting, averaged over all locations, WD, WD x HRC, WD x MB, WD x HY, the double cross hybrid and Pioneer X304 produced the longest ears. In the July and September plantings, Pioneer X304 produced the longest ears (Appendix Tablex 11 and 12).

The overall variety by location interaction was also significant. At Waimanalo and Kauai, the interaction of variety with date of planting was significant. Interactions of varieties with dates of planting for each location are presented in Figures 8a, 8b and 8c. At Waimanalo, longest ears were obtained for the May planting from Pioneer X304, Pioneer 3175, WD x HY and WD x HRC. In the July and September plantings, longest ears were obtained from Pioneer X304. In both the July and September plantings, ear length of Pioneer X304 was

Figure 8a. Effect of Varieties on Ear Length of Corn at Three Dates of Planting at Waimanalo (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 8b. Effect of Varieties on Ear Length of Corn at Three Dates of Planting at Kauai (D1=May Planting, D2=July Planting, and D3=September Planting).

Figure 8c. Effect of Varieties on Ear Length of Corn at Two Dates of Planting at Volcano (D1=May Planting and D2=July Planting).


EAR LENGTH (cm.)
22
18
14
10
D1
D2
D3
WD
MB
HY
WD× HRC
WD× MB
WD× HY
MB× HRC
HRC× HY
MB× HY
DOUBLE CROSS
X304
VARIETIES

associated with high yields (Appendix Tables 11 and 12).

Ear length was less variable at Kauai than at the other two locations for the May planting (Appendix Table 19). Except for the significantly shorter ears of Pioneer 3306, ear length was similar among the other varieties in the May planting. In the July and September plantings, Pioneer X304 produced the longest ears and had the highest ear yields of all the varieties evaluated.

Interactions of varieties with plant populations for each location are presented in Figures 9a, 9b and 9c. At Volcano, the interaction of variety with plant population was significant. At the lowest population, MB had significantly shorter ears than the other varieties. Ear lengths were similar among the other varieties at this population. At the middle plant population, ear length was similar for all varieties. At the highest plant population, significantly shorter ears were obtained only from MB x HY. Ear length was similar among the other varieties at this population.

D. Days to Tasseling and Silking

No information on days to tasseling was obtained at Volcano.

1) Effect of dates of planting, locations and their interactions on days to tasseling and silking of corn.

The interactions of days to tasseling and days to silking with plant populations, locations and dates of planting are presented in Tables 4 and 5. Detailed summary tables for days

Figure 9a. Effect of Varieties Grown at Three Plant Populations on Ear Length of Corn at Waimanalo (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).

Figure 9b. Effect of Varieties Grown at Three Plant Populations on Ear Length of Corn at Kauai (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).

Figure 9c. Effect of Varieties Grown at Three Plant Populations on Ear Length of Corn at Volcano (P1=34,580 Plants/ha, P2=44,460 Plants/ha, and P3=54,340 Plants/ha).

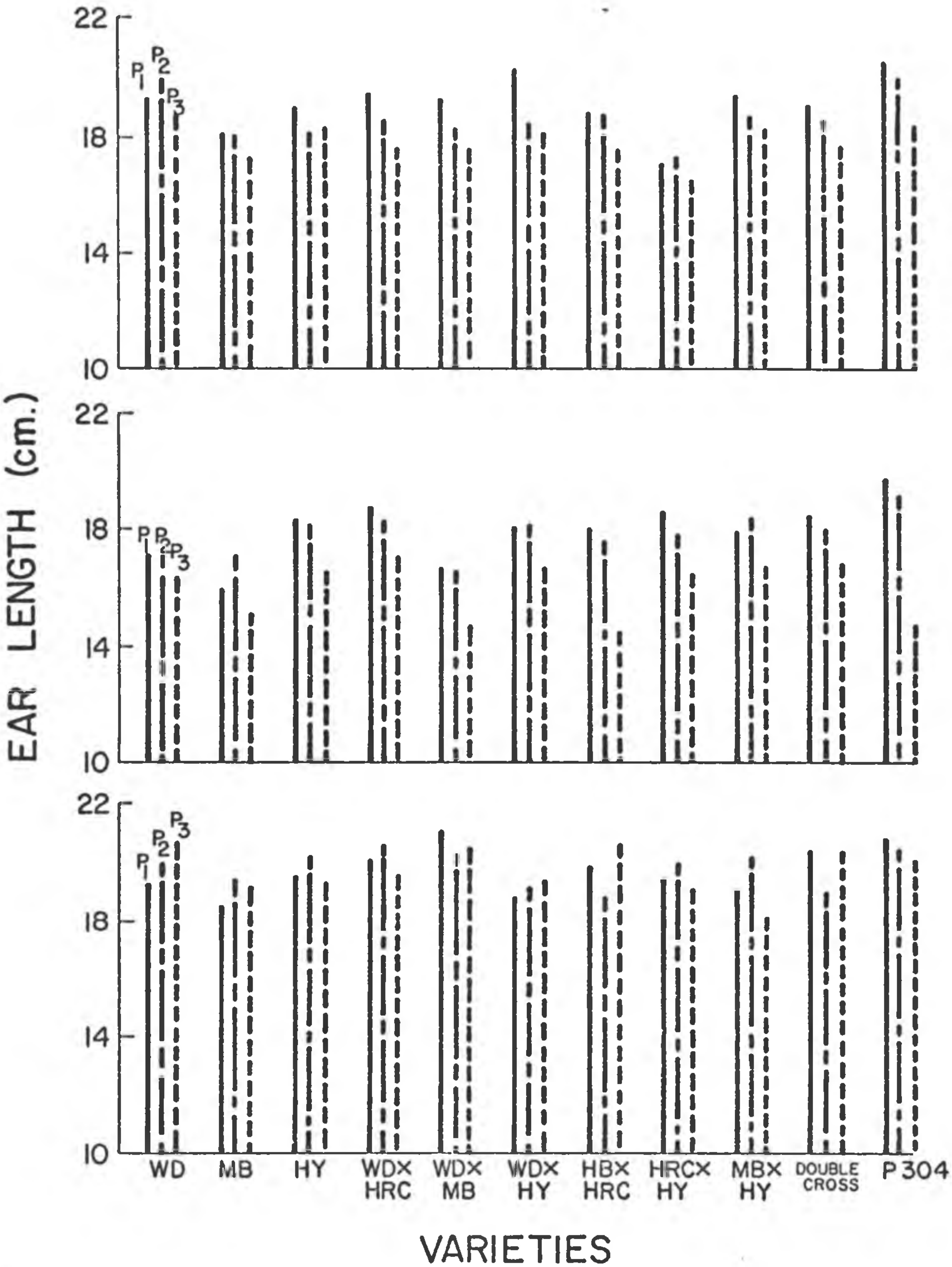

22
18
14
10
EAR LENGTH (cm.)
P_1
P_2
P_3
WD
MB
HY
WD× HRC
WD× MB
WD× HY
HB× HRC
HRC× HY
MB× HY
DOUBLE CROSS
P 304
VARIETIES

Table 4. Days to Tasseling of Corn as Influenced by Plant Population, Location and Date of Planting

	May Planting			May Means	July Planting			July Means	September Planting			September Means	Location Means	Means over Dates of Planting			Location Means
	Plants per hectare				Palnts per hectare				Plants per hectare					Plants per hectare			
	34,580	44,460	54,340		34,580	44,460	54,340		34,580	44,460	54,340			34,580	44,460	54,340	
Waimanalo	52	52	53	52	50	51	51	51	55	55	53	54	52	52	53	52	52
Kauai	57	62	62	60	63	61	62	62	63	62	63	63	62	61	62	62	62
Means	54	57	57	56	56	56	56	56	59	58	58	58	57	56	57	57	57

Table 5. Days to Silking of Corn as Influenced by Plant Population, Location and Date of Planting

	May Planting Plants per hectare			May Means	July Planting Palnts per hectare			July Means	September Planting Plants per hectare			September Means	Location Means	Means over Dates of Planting Plants per hectare			Location Means
	34,580	44,460	54,340		34,580	44,460	54,340		34,580	44,460	54,340			34,580	44.460	54.340	
Waimanalo	55	56	56	56	55	56	56	56	62	63	63	63	58	57	58	58	58
Kauai	64	68	69	67	70	68	69	69	71	71	71	71	69	68	69	70	69
Volcano	112	112	118	114	101	103	102	102	-	-	-	-	108	106	108	110	108
Means	77	78	81	79	76	76	76	76	66	67	67	67	74	77	78	79	78

to tasseling and silking are presented in the appendix (Tables 23 through 30). Days to tasseling were significantly less for the July planting than the May planting averaged over Waimanalo and Kauai. Days to silking were not different for the May and July planting dates averaged over the two locations. For the September planting date, a longer period was required to reach tasseling and silking than at either the May or July planting dates. Days to silking, averaged over all locations, were significantly less for the July planting than the May planting. The date of Table 5 indicate that this difference was due to a reduction in days to silking from 114 to 102 days at Volcano.

The time required to go from planting to tasseling and silking was shorter at Waimanalo than at Kauai. Days to silking at Volcano was about twice as long as at Waimanalo.

There were significant location by date of planting interactions for tasseling and silking dates. Interactions of locations with dates of planting for tasseling and silking are presented in Figures 10a and 10b. At Waimanalo, tasseling was earliest for the July planting. At Kauai, for the May planting, tasseling was two days earlier than the July planting and three days earlier than the September planting.

At Waimanalo, in the May and July plantings, silking occurred eight days earlier than the September planting. At Kauai, days to silking was increased by two days as planting was delayed from May to July and from July to September.

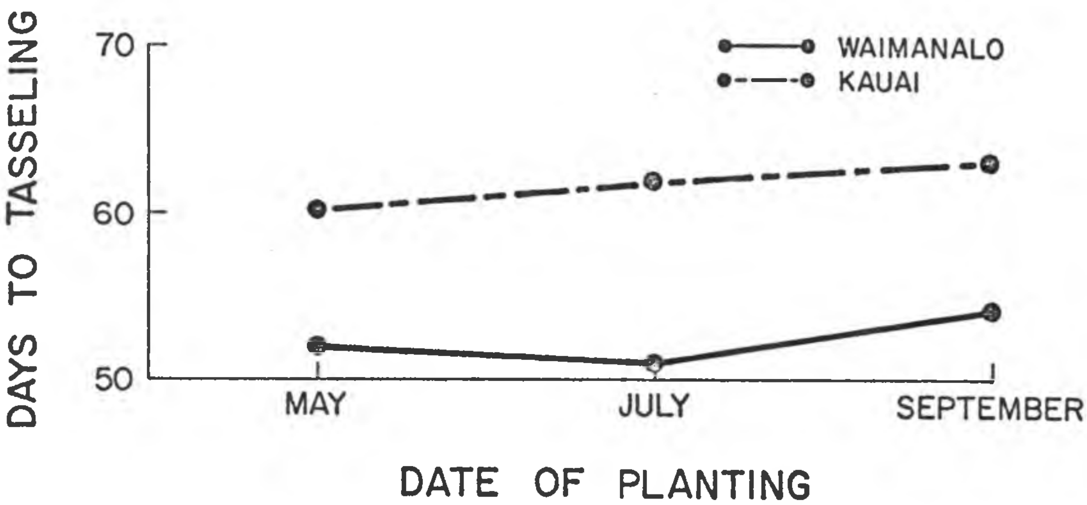


Figure 10a. Effect of Date of Planting on Days to Tasseling of Corn at Two Locations

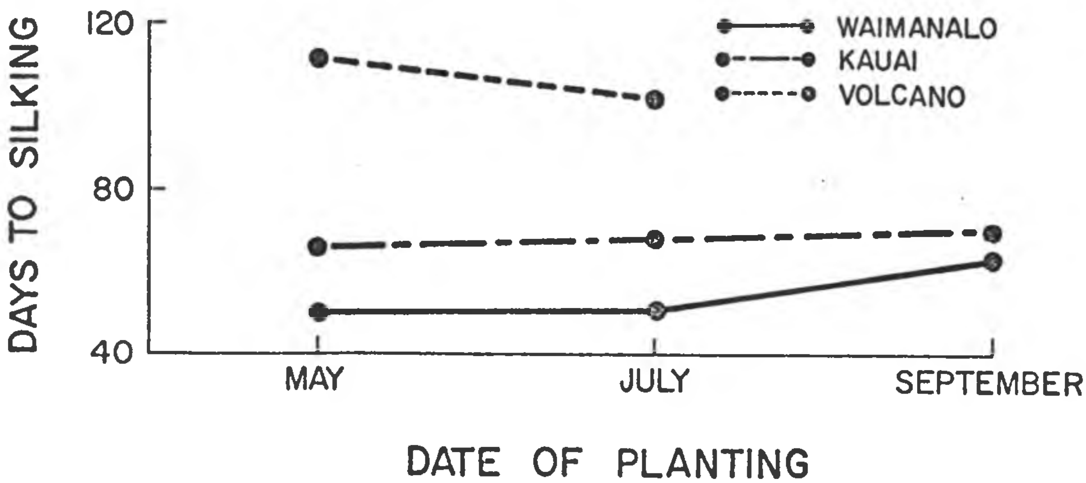


Figure 10b. Effect of Date of Planting on Days to Silking of Corn at Three Locations

Date of planting had a greater effect on silking dates at Volcano than at Waimanalo or Kauai. The May planting at Volcano required an average of 12 days more to reach the 50 percent silking stage than the July planting.

2) Effect of plant populations and their interactions with dates of planting and locations on days to tasseling and silking of corn.

The effects of plant population, dates of planting and locations on days to tasseling and silking are presented in Tables 4 and 5. Plant population had little or no effect on days to tasseling at any one location. The interaction of plant population with date of planting was significant. In the May planting, tasseling was delayed by three days when plant population was increased from 34,580 to 44,460 plants/ha. There was no further delay in tasseling when population was increased to 54,340 plants/ha. For the July and September plantings, days to tasseling were similar for the three plant populations averaged over Waimanalo and Kauai.

Over all locations, silking dates varied significantly with plant population at the May planting date. This was probably brought about by the large increase in days to silking observed at Volcano at the highest population.

When the data for May were averaged over locations, silking was delayed by one day when plant population was increased from 34,580 to 44,460 plants/ha and by an additional three days as plant population was further increased to 54,340 plants/ha. In the July planting, silking dates were similar for all plant populations.

There was no difference in days to silking among plant populations at all planting dates at Waimanalo, and for the July and September planting dates at Kauai. The average number of days to silking, averaged over plant populations and dates of planting, was 58, 69 and 108 days for Waimanalo, Kauai and Volcano, respectively. The significant effect of plant population on days to silking at Volcano was due to the six-day delay in silking as plant population increased from 44,460 to 54,340 plants/ha at the May planting.

3) Effect of varieties and their interactions with dates of planting, locations, and plant populations on tasseling and silking.

The number of days from planting to tasseling and silking varied among varieties. The variety by date of planting, variety by location and variety by plant population interactions were all significant.

In the May planting Pioneer X304 was the earliest tasseling and silking variety and WD x HRC was the latest tasseling variety. In the July planting, Pioneer X304, HY and MB x HY were the earliest tasseling and silking varieties and WD x HRC, WD and MB x HRC were the latest tasseling varieties. At the September planting date, HY and MB x HY were the earliest tasseling and silking varieties, WD x HRC was the latest tasseling variety and WD was the latest silking variety.

As seen from summary tables in the appendix (Tables 25 and 30), the period between appearance of tassel and silk differed among varieties. This will explain the fact that despite the high correlations between days to tasseling and days to silking (Appendix Tables 41 through 50) the varietal response for tasseling was not identical with the response for silking.

For the May and July plantings, averaged over plant populations and over Waimanalo and Kauai, a greater effect of date of planting was observed on tasseling than on silking. Tasseling dates were usually earlier among varieties in the July planting than the May planting. Tasseling of WD was later in the July planting and there was no difference in days to tasseling for Pioneer X304 in the May and July plantings.

Days to silking for the varieties, averaged over Waimanalo and Kauai, was influenced relatively little by date of planting for the May and July plantings. Over all locations, earlier silking was observed among varieties in the July planting than the May planting. This trend was primarily attributed to the response of varieties to date of planting at Volcano.

Among the parental lines, HY and MB had the earliest tasseling and silking dates. Regardless of date of planting, days to tasseling and silking for MB x HRC and HRC x HY were greater than HY and MB.

Interactions of varieties with locations are presented in Appendix Tables 25 and 30. All varieties were observed to tassel and silk earlier at Waimanalo than at Kauai and Volcano.

At Waimanalo, MB, HY and MB x HY tasseled and silked the earliest. Pioneer X304 silked earliest, WD x HRC tasseled latest, and WD and WD x HRC silked latest. At Kauai, the double cross hybrid tasseled and silked earliest, WD x HRC tasseled latest, and WD silked latest. At Volcano, HY and Pioneer X304 silked earliest and HRC silked latest. When averaged over all locations and dates of planting, relatively earlier silking was observed among the mainland hybrids.

At Waimanalo, MB, HY and their cross, MB x HY, tasseled and silked earlier than the other single crosses. The double cross hybrid was observed to tassel and silk earlier than the single crosses.

At Kauai, the double cross hybrid tasseled and silked earlier than any of the parents and single crosses and WD was the latest. At Volcano, WD x HY was observed to silk as early as HY. The other single crosses were observed to silk earlier than HRC and later than MB, HY and the double cross hybrid. It was observed that tasseling and silking for the mainland hybrids were comparable with the early local varieties within the same date of planting over all locations.

The response to plant population was similar among varieties for silking dates. Silking was delayed by about one day for every 10,000 plant increase in plant population from 34,580 to 54,340 plants/ha. Tasseling among varieties was not influenced by plant population.

E. plant and ear heights

1) Effect of dates of planting, locations and their interactions on plant and ear heights.

Detailed summary tables for plant and ear heights are presented in the appendix (Tables 31 through 40). The average effects of dates of planting at the three locations on plant and ear heights are presented in Figures 11a and 11b. The response to dates of planting was similar for plant and ear heights, averaged over plant populations and locations. Plant and ear heights declined from the May to the July and September plantings.

There was a significant location by date of planting interaction for plant and ear heights. In the May planting, tallest plants and highest ear attachments were observed at Waimanalo. In the July planting tallest plants and highest ear attachments were observed at Volcano. Regardless of planting date, plants were shortest and ear height lowest at Kauai.

2) Effect of plant populations and their interactions with dates of planting and locations on plant and ear heights.

The effects of plant populations, dates of planting and locations on plant and ear heights are presented in Tables 6 and 7. Plant and ear heights varied among plant populations at each planting date. Plant and ear heights, averaged over locations, increased with increasing plant population at the July and September planting dates. Plant height, at the May planting date, averaged over locations, decreased as plant

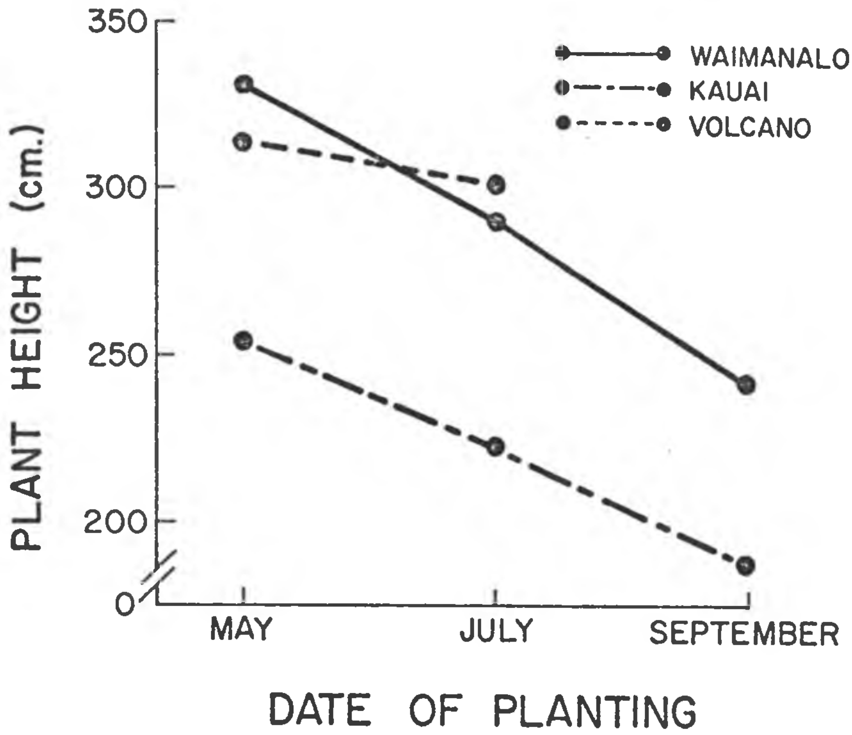


Figure 11a. Effect of Date of Planting on Plant Height of Corn at Three Locations

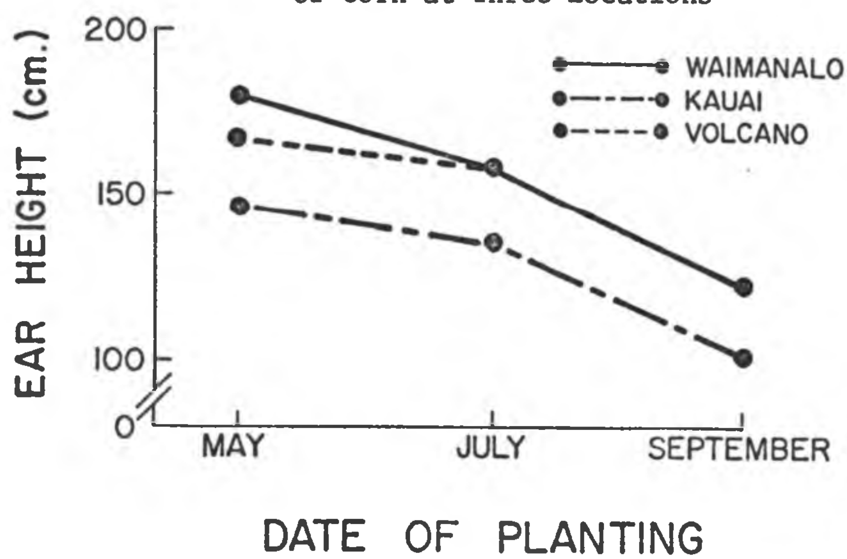


Figure 11b. Effect of Date of Planting on Ear Height of Corn at Three Locations

Table 6. Plant Height of Corn (cm) as Influenced by Plant Population, Location and Date of Planting

	May Planting			May	July Planting			July	September Planting			September	Location	Means over Dates of Planting			Location
	Plants per hectare				Palnts per hectare				Plants per hectare					Plants per hectare			
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Means	34,580	44,460	54,340	Means
Waimanalo	315	314	319	316	290	275	284	283	238	243	252	244	288	221	216	227	288
Kauai	252	241	230	241	201	242	223	222	186	191	179	185	238	213	225	216	238
Volcano	300	313	311	308	287	302	300	296	-	-	-	-	302	307	324	319	302
Means	289	289	285	288	263	276	274	271	212	217	216	215	258	247	255	254	258

Table 7. Ear Height of Corn (cm) as Influenced by Plant Population, Location and Date of Planting

	May Planting Plants per hectare			May Means	July Planting Palnts per hectare			July Means	September Planting Plants per hectare			September Means	Location Means	Means over Dates of Planting Plants per hectare			Location Means
	34,580	44,460	54,340		34,580	44,460	54,340		34,580	44,460	54,340			34,580	44,460	54,340	
Waimanalo	163	161	171	165	152	151	158	156	118	123	127	123	153	144	145	152	153
Kauai	140	134	131	135	118	152	132	134	102	107	104	104	128	120	131	122	128
Volcano	157	163	157	159	150	161	162	159	-	-	-	-	-	102	108	106	159
Means	153	152	153	153	144	154	151	150	110	115	116	114	139	122	128	123	

population increased. Ear height at the May planting date, averaged over locations, showed little or no change with increasing plant population. The interaction of plant population with location for plant height was significant.

3) Effect of varieties and their interactions with dates of planting, locations and plant populations on plant and ear heights.

The response was similar among varieties for plant height averaged over all locations for the May and July plantings. The varieties HRC and WD were tallest and Pioneer X304 was shortest. The hybrid WD x MB was shorter in height than WD but similar in height to MB. The hybrid MB x HY was shorter in height than HY and similar in height to MB. All single crosses involving WD and HRC, with the exception of WD x HRC, were taller than the other parent used in these crosses.

In considering plant height of varieties at Waimanalo and Kauai over the three dates of planting the following observations were made. In the May planting, WD, WD x HRC, WD x HY, HRC x HY and the double cross hybrid had the tallest plants. In the July planting, WD, WD x HRC and the double cross hybrid had the tallest plants. Averaged over all planting dates, MB and all of its single cross hybrids were shorter than the other local varieties. Pioneer X304 had the shortest plants regardless of planting date. All varieties crossed with MB produced plants which were similar in height to MB. Hybrids from crosses involving WD and HY were as tall as WD and HY.

The interaction of varieties with dates of planting was significant for ear height. In the May planting, the varieties with tallest plants, WD, WD x HRC, WD x HY, HRC x HY and the double cross hybrid, had the highest ear height. In the July planting, ear height of the double cross was lower than the previously mentioned varieties. Ear heights among the other varieties were similar. The varieties with highest and lowest ear heights in the May and July plantings behaved similarly in the September planting. MB, HY and their hybrids had similar ear heights in the last planting. Regardless of planting date, Pioneer X304 had the lowest ear height.

There was a significant variety by location interaction for plant and ear heights. At Waimanalo and Kauai, the interaction of varieties with date of planting was significant for plant height. For the May planting at Waimanalo, tallest plants were observed in all single crosses with HRC. The mainland hybrids produced the shortest plants. In the July planting, WD was the tallest variety and Pioneer X304 was the shortest variety. Plant heights were similar for the other varieties. In the September planting, the double cross hybrid, HY, WD and WD x HY were the tallest varieties.

There was a general decline in ear height for all varieties at Waimanalo as planting date was changed from May to July to September.

At Kauai, for the May planting date, WD, WD x HRC and the double cross had the highest plants and highest ear attachments.

The mainland hybrids had the shortest plants and lowest ear attachments. Plant and ear heights among the parental lines and their hybrids were similar except for MB x HY. In the July planting, WD and WD x HRC had the tallest plants and highest ear attachments. For both the July and September plantings, WD x MB and MB x HY were similar in plant and ear heights to MB and were also lower in plant and ear heights than the other local varieties.

At Volcano plant and ear heights were similar over all plant populations for the May and July planting dates.

DISCUSSION

Results obtained in this study indicate that in Hawaii planting at several locations in one or more seasons will provide a wide range of environments for testing varieties. Testing for several years would be a more reliable method than testing for one year but a breeding program would be delayed unnecessarily. All agronomic characters measured in the study were found to vary with date of planting. The varieties behaved differently in different seasons as shown by the significant variety by date of planting interaction. The significant interactions between locations and dates of planting and between varieties and locations demonstrated that plant development is greatly affected by the variation in environmental conditions found at the three locations considered in the study. The effect of soil moisture, sunlight, and other environmental factors vary with different plant populations. The conditions prevalent during the growing season for each planting at each location and plant population, therefore, characterize a specific environment.

Early planting proved to be more advantageous than late planting within any one location. Planting in May resulted in a growing season characterized by warm temperatures and high radiation levels. As a result, highest ear and stover yields were obtained from the May planting. Gautam, et al. (1964) obtained highest grain and stover yields in India from early plantings. Similar results were obtained in Missouri by Zuber (1967) as reported by Keaster, et al. (1969). A delay in planting until September resulted in poor stands and poorer growth due to a number of factors. These included poorer sunlight conditions, decreasing daylength and temperatures, increase in diseases such as mosaic and blight, and stalk breakage and lodging brought about by heavy rains and strong winds as the winter season was approached. Brewbaker, et al. (1966) noted that protracted cool weather, especially at high elevations in Hawaii, suppressed winter corn growth and greatly retarded the growth of spring plantings.

The varietal variation observed in plant population indicate that breeding and testing of hybrids under varying levels of plant population is necessary if the yield of corn is to be increased substantially.

The response of ear yield to dates of planting was influenced by location. The highest ear yields were obtained at Kauai when corn was planted in May but yield decreases with increasing population indicate moisture may have been a limiting factor. At the July planting date, highest yields were obtained at Waimanalo. This variable response to planting date at the two locations may be associated with the effect of rainfall and available soil moisture. Temperatures observed at Waimanalo and Kauai were not greatly different during the growth of the two crops. Although no data were collected, the differences between the two locations at the second planting date may be partially due to reduced sunlight at Kauai.

At Volcano, the average monthly maximum temperature for the summer months rarely reaches 65°F and the average minimum temperature is about 52°F. During the winter months, the average monthly maximum and minimum temperatures are about 10°F lower. Optimum temperatures, as described by Colville (1967a) for corn production, are never reached and consequently corn yields are greatly reduced at Volcano as planting is delayed from May to September. However, when radiation levels are high as in the May to August growing period, yields were greater at Volcano than at Waimanalo, indicating that some factor greatly limited yields at Waimanalo where favorable growth temperatures prevailed.

The response of ear yields to population was not consistent at all locations. There was a limited amount of rainfall at Kauai during the months May through October. Moisture stress may have caused the reduction in yields at higher population in this location in the first and second plantings. Lower ear yields for the September planting at the higher plant populations at Waimanalo and Kauai were due to the high incidence of mosaic. At Waimanalo and Volcano, lodging was also a problem.

The high ear yields of HY and Pioneer X304 at Waimanalo and Kauai indicate the better adaptability of these two varieties at low elevations. In contrast, WD produced high yields when grown at Volcano. Over all locations, the varietal crosses, except WD x MB, showed better yielding ability than MB and WD. At Waimanalo and Volcano, HY yielded better than the local hybrids. The effect of shading of the shorter varieties by the taller varieties due to the use of single row plots may also have been responsible for the low yield of such short varieties as Pioneer X304. However, at the low plant populations the shorter varieties yielded as well as the taller varieties. It was only with increased plant populations that the shorter varieties were reduced in yield. At Kauai, where plants did not grow as tall as at Waimanalo and Volcano, Pioneer X304 responded well to plant population. Because of the high susceptibility to mosaic, HRC, Pioneer 3306, Pioneer 3175, and IXL 9, did not survive the winter months. Their yields were comparable to the other varieties for the May planting.

The increase in stover yields obtained at Waimanalo and Volcano at higher plant populations were similar to the results of Rutger and Crowder (1967) and Bryant and Blaser (1968). Williams, et al. (1965a and 1965b) observed that the proportion of the total dry matter found in the stalks declined with increasing plant population. They found that size of individual plants was greatly reduced at high populations through reduction in photosynthesis per plant. This may have caused the stover yield decline at Kauai at higher populations. Pendleton (1968) indicated that light was the limiting factor to high yields under dense plantings.

Corn failed to survive at Volcano when planted in September. This was mainly due to a severe Helminthosporium leaf blight attack and the low temperatures at this location. Brewbaker, et al. (1966) observed that leaf blight is occasionally severe in Hawaii under moist cool conditions. They further commented that Volcano is too cold for winter corn production but produced good summer crops. The results of the present study further corroborated this observation as ear yields were considerably higher at Volcano than at Waimanalo when planted in May.

Ear length decreased as the plant population was increased or as the date of planting was delayed. Brewbaker, et al. (1966) reported that a reduction in ear length was most notable in the winter months. Rossman and Cook (1967) reported that size of ears decreased as population increased.

Tasseling and silking occurred latest with the May planting when days were longer and daylength was increasing. Days to tasseling and silking were greater in July and still greater in September when days were shorter and daylength was decreasing. Similar results were reported by Jenkins (1941), Hesketh, et al. (1969) and Francis, et al. (1970). The International Maize and Wheat Improvement Center in Mexico (Anonymous, 1969) reported that as the daylength at planting became shorter, there was an increase in the number of days to flowering. The delay in silking and tasseling mentioned above was thought to be mainly due to temperature effects which differed between these two growing seasons. Jenkins (1941) explained that low temperatures greatly retarded flowering and maturing and produced an effect similar to that of variation in daylength. Andrew, et al. (1956) claimed that there is ample evidence of the interaction of light and temperature affecting time of flowering.

Earlier tasseling and silking were noted among the mainland hybrids particularly at Waimanalo and Kauai. The same observation was made by Brewbaker, et al. (1966) who found that mainland sweet corn matured much earlier at low elevations in Hawaii than on the mainland and earlier than at higher elevations in Hawaii.

The delay in tassel and silk emergence at high populations is mainly attributed to increasing competition for light when plants become crowded. It was noted that the period between tasseling and silking became longer with increasing plant population. Earley, et al. (1966) reported that the number of days from planting to tasseling and silking increased in a curvilinear manner with reduction in light. They noted that the number of days between tassel and silk emergence increased as light was reduced. Similar results were also obtained by early investigators -

Dungan, et al. (1958), Stringfield and Thatcher (1947), and by Rossman and Cook (1967) - who observed that the time interval between tassel and silk emergence increased as rate of planting increased.

Within the same season, plants grew taller with increasing population. This behavior of corn plants under high populations or shaded conditions was also observed by other investigators including Stinson and Moss (1960), Earley, et al. (1966) and Giesbrecht (1969). McCalla, et al. (1939) attributed this response of corn to the alteration of hormonal balance which could alter plant height under low light condition.

Ear height at Waimanalo and Volcano, over dates of planting, varied significantly with increasing populations. However, at Kauai, ear height was not significantly influenced by plant population. Results similar to those at Kauai were reported by Rutger and Crowder (1967) for ear height. Also, a report by the International Maize and Wheat Improvement Center at Mexico (Anonymous, 1969) indicated that ear height appeared to be less subject to environmental influence at high than at low plant populations.

SUMMARY AND CONCLUSIONS

Fifteen varieties of corn were evaluated by planting in May, July and September at the Waimanalo Experiment Station, the Kauai Branch Station and the Volcano Station. In addition to the location and date of planting variables, plantings were made at 34,580, 44,460 and 54,340 plants/ha. Unfavorable climatic conditions resulted in complete loss of the September planting at the Volcano Station.

All growth and yield characteristics of the varieties examined were affected by location, planting date and plant population. Under a given set of environmental conditions, maximum ear yield for any one variety was obtained at a specific plant population. Total stover production will increase or remain at the maximum if populations are increased but ear yield may be severely penalized by high plant populations. At low temperature and low radiation levels, greater ear yields are generally obtained at lower population levels. Significant variety by location and variety by season interactions indicated a need to develop high yielding varieties adapted to specific locations and seasons.

Highest ear and stover yields were obtained with early plantings. Late planting resulted in low yields due to increased cloudiness, low temperatures, excessive rainfall and strong winds which caused heavy lodging. The increased incidence of mosaic at the lower elevation and leaf blight at high elevation decreased yields of the September plantings.

Kauai had the highest ear yields in the May planting, Waimanalo was highest in the July planting, and there was no real difference between the two locations for the September planting. Ear yields for Volcano were lowest in the July planting.

HY and Pioneer X304 yielded best at low elevations. HY yielded better than its crosses. WD and HRC were the highest yielding lines at the higher elevation. When planted in May, they were similar in yield to the other varieties at low elevations. The yielding characteristics of MB and WD were improved in all crosses except MB x WD. At high elevation, HRC x HY yielded lower than either of the parents.

Due to high disease susceptibility, temperate zone hybrids may not be able to survive in Hawaii during the winter months. However, when grown during the summer months, they may perform as well as or better than local varieties.

High susceptibility to mosaic prevented HRC from surviving at low elevations during the winter months. This susceptibility was transmitted to all HRC crosses.

In contrast to ear yields, stover yields were highest at Waimanalo, intermediate at Kauai and lowest at Volcano for the May and July plantings. In the September planting, higher stover yields were obtained from Kauai. The stover yield of all the varieties decreased as planting date was delayed from May to September.

Ear and stover yields were maximum at Volcano in all dates of planting at a plant population of 44,460 plants/ha. At Waimanalo, ear and stover yields increased with plant population to 54,340 plants/ha. There was no response at Kauai to plant populations.

At Waimanalo, all varieties gave increased ear and stover yields with increasing population. However, Pioneer X304, a shorter and earlier hybrid, showed no increase in yield at the highest population when grown in single-row plots with tall and late varieties. At Kauai and Volcano, yields increased with plant population only to 44,460 plants/ha.

Plant height, ear height and ear length were reduced significantly while tasseling and silking occurred earlier as date of planting was delayed from May to July and September.

With increasing population, plant and ear heights increased while ear length decreased. Tasseling and silking were delayed and the period between appearance of these two plant structures became longer as plant population was increased.

Thin and shorter plants resulted from delayed planting and, in the presence of bad weather, became more susceptible to lodging in the later planting dates. Lodging was heavier at higher population levels.

Table 8. Ear Yield of Corn (kg/ha, dry weight), as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	5824a*	7743bcde	7520ab	7029abc	5244ab	5575a	7781abcd	6200ab	3403ab	3523ab	2984a	3303a	5511a
2. H R C	8621b	8479bcde	7440ab	8180cdef	-	-	-	-	-	-	-	-	-
3. Mayorbella	5533a	6181ab	6852ab	6189ab	4547a	5709a	7403ab	5886a	4352abcd	4704abc	5018b	4691a	5589a
4. Hawaiian Yellow	8298b	10162e	12927c	10462b	7551de	7850bc	9528d	8309d	4981cd	5277c	6356b	5538a	8103d
5. WD X HRC	7033ab	8529bcde	8399ab	7987cdef	6003bc	6558ab	7963abcd	6841abc	3860ab	4445abc	5324b	4543a	6457b
6. WD X MB	6067a	5712a	6441a	6073a	5394ab	6124ab	6880a	6133ab	2960a	3309a	3171a	3146a	5117a
7. WD X HY	9254b	9252de	10557b	9687gh	7820e	6511ab	8716abcd	7682cd	4586bcd	4989bc	5754b	5110a	7493c
8. MB X HRC	7134ab	6506abcd	8524ab	7388cde	6341bcd	6828abc	7465abc	6878abc	3757abc	5633c	5800b	5063a	6443b
9. HRC X HY	6622a	8704bcde	8693ab	8006cdef	6469bcd	6320ab	8496abcd	7095bc	4608bcd	5189c	6087b	5294a	6799b
10. MB X HY	6756ab	6374abc	8556ab	7229bcd	6866cde	6745abc	9161bcd	7591cd	4970cd	5179c	6265b	5471a	6764b
11. (HYXWD)X(MBXHRC)	8186b	9196cde	10202b	9195efg	6460bcd	7173abc	9423cd	7685cd	4620bcd	5791c	6656b	5689a	7523c
12. Pioneer X304	8621b	9996e	9912ab	9510fg	6512bcd	8628c	7751abcd	7630cd	5549d	5877c	6659b	6028a	7723cd
13. Pioneer 3175	7361ab	8125bcde	8229ab	7905cdef	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	8516b	8997bcde	9487ab	9000defg	-	-	-	-	-	-	-	-	-
15. IXL 9	8236b	6628abcd	9785ab	8216cdef	4215a	5973ab	7837abcd	6008a	-	-	-	-	-
Mean	7471	8039	8902	8069	6118	6666	8200	7085	4331	4901	5461	4898	7577

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 9. Ear Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	11137b*	7933ab	5518a	8196a	3084a	4579ab	3994ab	3886a	3363a	3292a	4158ab	3604a	5229a
2. H R C	13823d	6223a	7096a	9047a	4683abc	6324bcd	7586cd	6197bcd	-	-	-	-	-
3. Mayorbella	8506a	11522bcd	11940ab	10656a	3438ab	5070bc	2919a	3809a	3475a	3469a	5001abc	3982ab	6149abc
4. Hawaiian Yellow	11193b	11509bcd	9367a	10690a	5617cd	9903f	6312c	7277d	4878bc	5310b	6006cde	5398c	7788de
5. WD X HRC	13324cd	11290bcd	9249a	11287ab	5276bc	6862cd	7026cd	6388bcd	5325bc	5317b	6768def	5803cd	7826de
6. WD X MB	9993ab	11916cd	8321a	10076a	2927a	3094a	3181a	3067a	4124ab	3110a	3359a	3531a	5558ab
7. WD X HY	11389bc	10637bcd	9462a	10496a	5188bc	5636bcd	5705bc	5510b	5112bc	4571ab	4933abc	4872bc	6959cde
8. MB X HRC	14007d	9773abcd	6067a	9949a	4679abc	5917bcd	7557cd	6051bc	5541bcd	7329c	7169ef	6679de	7560de
9. HRC X HY	12806cd	11118bcd	8260a	10728a	5753cd	7569de	7327cd	6883bcd	5344bc	5331b	5463bcd	5379c	7663de
10. MB X HY	8726a	11724bcd	7117a	9189a	4278abc	6690cd	5570bc	5512b	5071bc	5546b	4988abc	5201c	6634bcd
11. (HYXWD)MBXHRC	12888cd	13043d	9636a	11855ab	5790cd	6600cd	6768cd	6386bcd	6818d	7258c	5921cde	6666de	8135e
12. Pioneer X304	11843bc	11939cd	19016b	14266b	7375d	9030ef	8733d	8379e	5701cd	7307c	7707f	6905e	9850f
13. Pioneer 3175	8934a	10152bcd	8960a	9349a	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	9205a	9691abcd	6774a	8556a	-	-	-	-	-	-	-	-	-
15. IXL 9	9022a	8537abc	8208a	8589a	-	-	-	-	-	-	-	-	-
Mean	11120	10467	8999	10672	4840	6439	6056	5741	4977	5258	5588	5229	8206

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 10. Ear Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting Plants Per Hectare 34,580	44,460	54,340	May Means	July Planting Plants Per Hectare 34,580	44,460	54,340	July Means	Means Over Dates
1. Waimea Dent	8853abc*	11288a	9251abcd	9797bc	3533a	3707a	4011abcd	3750abc	6774abc
2. H R C	8020ab	9478a	8933abc	8810ab	4356a	4380a	3180abc	3972abcd	6391abc
3. Mayorbella	7570ab	9097a	8749abc	8472ab	3618a	3546a	3081ab	3415abc	5943ab
4. Hawaiian Yellow	7272ab	10306a	9917bcd	9165bc	3354a	4421a	3592abc	3789abcd	6477abc
5. WD X HRC	10315bc	11369a	12867f	11517d	4619a	4417a	5845d	4960d	8239c
6. WD X MB	10071bc	10732a	8817abc	9873bc	4920a	4287a	3439abc	4215abcd	7044abc
7. WD X HY	9354abc	9721a	10488bcde	9854bc	3672a	3833a	5669cd	4391abcd	7123abc
8. MB X HRC	11190c	11138a	11538def	11288cd	4922a	3937a	5070abcd	4643bcd	7966bc
9. HRC X HY	9237abc	8415a	7005a	8219ab	3602a	3332a	2832a	3255ab	5737a
10. MB X HY	8607abc	11008a	8677ab	9430bc	3544a	4998a	4628abcd	4390abcd	6910abc
11. (HYXWD)(MBXHRC)	9653abc	9123a	12651ef	10475bcd	4909a	4163a	5589bcd	4887cd	7681abc
12. Pioneer X304	9513abc	9754a	9611bcd	9626bc	4014a	3675a	4321abcd	4003abcd	6815abc
13. Pioneer 3175	8107abc	10012a	11114cde	9744bc	3835a	3987a	2855a	3559abcd	6651abc
14. Pioneer 3306	9554abc	8331a	10175bcd	9353bc	3620a	3351a	2608a	3193ab	6273abc
15. IXL 9	6930a	8586a	6968a	7494a	3800a	2706a	2530a	3012a	5253a
Mean	8950	9890	9784	9541	4021	3916	3950	3962	6751

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 11. Ear Yield of Corn (kg/ha dry weight) as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	4824a	5614ab	6095ab	5511a	5861a	5268a	4557a	5229a	5343ab	5326a	5441a	5370a
2. Mayorbella	4810a	5531ab	6424ab	5589a	5140a	6687abc	6620a	6149abc	4975a	6522b	6109ab	5869a
3. Hawaiian Yellow	6943cd	7763ef	9603e	8103d	7229b	8907d	7228a	7788de	7086cd	8416e	8335c	7946d
4. WD X HRC	5632b	6510bcd	7229bc	6457b	7975ab	7823bcd	7681a	7826de	6803b	7455cd	7167abc	7142bc
5. WD X MB	4807a	5048a	5497a	5117a	5681a	6040ab	4953a	5558ab	5244ab	5225a	5544ab	5338a
6. WD X HY	7220d	6917cde	8342cd	7493c	7230b	6948abc	6700a	6959cde	7225cd	7521cd	6932abc	7226bc
7. MB X HRC	5744b	6322bc	7263bc	6443b	8075ab	7673bcd	6931a	7560de	6909bc	7097bc	6997abc	7001b
8. HRC X HY	5899b	6738cd	7759cd	6799b	7968ab	8006cd	7017a	7663de	6934bc	7388bcd	7372abc	7231bc
9. MB X HY	6197bc	6099bc	7994cd	6764b	6025a	7987cd	5891a	6634bcd	6111b	6943bc	7043abc	6699b
10. (HYXWD)(MBXHRC)	6422bcd	7387def	8761de	7523c	8498b	8967d	6939a	8135e	7460cd	8236de	8177bc	7829cd
11. Pioneer X304	6894cd	8167f	8107cd	7723cd	8306b	9425d	11818b	9850f	7600cd	9963f	8796c	8786e
Mean	5945	6554	7552	6684	7090	7612	7010	7214	6517	7083	7246	6948

Table 12. Ear Yield of Corn (kg/ha, dry weight) as Influenced by Plant Populations at Two Dates of Planting and Three Locations

Varieties	Waimanalo Plants Per Hectare 34,580	44,460	54,340	Waimanalo Means	Kauai Plants Per Hectare 34,580	44,460	54,340	Kauai Means	Volcano Plants Per Hectare 34,580	44,460	54,340	Volcano Means	Means Over Locations Plants Per Hectare 34,580	44,460	54,340	Variety Means
1. Waimea Dent	5534a*	6659abc	7650abc	6615ab	7110a	6256a	4756a	6041a	6193a	7498a	6631bc	6774abc	6279ab	6804a	6346a	6476ab
2. Mayorbella	5040a	5945a	7127ab	6037a	5972a	8296abc	7430a	7232abc	5594a	6322a	5915ab	5943ab	5535a	6854a	6824ab	6404a
3. Hawaiian Yellow	7924ef	9006e	11227f	9386f	8405b	10706d	7839a	8983c	5313a	7363a	6755bc	6477abc	7214cd	9025b	8607bc	8282def
4. WD X HRC	6518bc	7543bcd	8181abcde	7414cd	9300b	9076bc	8137a	8838c	7467a	7893a	9356d	8239c	7762d	8171ab	8558bc	8163cdef
5. WD X MB	5730ab	5918a	6660a	6103a	6460a	7505a	5751a	6572ab	7495a	7510a	6128ab	7044abc	6562bc	6977a	6180a	6573ab
6. WD X HY	8537f	7881cd	9636de	8685e	8289b	8136ab	7584a	8003bc	6513a	6777a	8078cd	7123abc	7780d	7598a	8433bc	7937cde
7. MB X HRC	6737cd	6667abc	7994abcd	7133bc	9343b	7845a	6812a	8000bc	8056a	7537a	8304cd	7966bc	8045d	7350a	7703ab	7699cde
8. HRC X HY	6545bc	7512bcd	8595bcde	7551cd	9280b	9344bcd	7793a	8805c	6420a	5874a	4918a	5737a	7415d	7576a	7102ab	7364bcd
9. MB X HY	6811cd	6560ab	8858cde	7410cd	6502a	9207bcd	6343a	7351abc	6075a	8003a	6652bc	6910abc	6463bc	7923ab	7285ab	7223abc
10. (HYXWD)X(MBXHRC)	7323cde	8185de	9813ef	8440de	9339b	9822bcd	8202a	9121c	7281a	6643a	9120d	7681abc	7981d	8216ab	9045bc	8414ef
11. Pioneer X304	7567de	9312e	8831cde	8570e	9609b	10485cd	13874b	11323d	6763a	6714a	6966bc	6815abc	7980d	8837b	9891c	8902f
Mean	6752	7381	8598	7577	8146	8789	7684	8206	6652	7103	7166	6973	7183	7757	7816	7585

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 13. Stover Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	11448def*	14088c	12736a	12758de	12450c	9367abcd	10467ab	10761abcd	6124ab	7036ab	9698c	7619cde	10379a
2. H R C	14579gh	14791c	15242a	14871ef	-	-	-	-	-	-	-	-	-
3. Mayorbella	9171abcd	10357ab	10711a	10080abc	7322ab	9190abc	9535ab	8682ab	3878a	4852a	6403ab	5044a	7935a
4. Hawaiian Yellow	11006cdef	11466b	17609a	13360e	9302bc	8773abc	11887abc	9987abc	4984a	5363ab	6736ab	5694ab	9681a
5. WD X HRC	16412h	15732c	16644a	16263f	11039bc	11357cd	14555bc	12317d	7831b	8461bc	8834bc	8375e	12318a
6. WD X MB	10948cdef	11933b	13188a	12023cde	9849bc	10698bcd	13146abc	11231bcd	5986ab	6475ab	7655abc	6705bcd	9986a
7. WD X HY	13379fg	12035bc	17287a	14234ef	10086bc	10113bcd	14100bc	11433bcd	5306a	5396ab	7843abc	6182abc	10616a
8. MB X HRC	12082efg	10682ab	17650a	13471e	9850bc	10418bcd	16390c	12219cd	5095a	10607c	8811bc	8171de	10993a
9. HRC X HY	12687fg	15160c	16093a	14647ef	10685bc	11218cd	14149bc	12017cd	5806ab	5859ab	7095abc	6253abc	10972a
10. MB X HY	9715bcde	10406ab	11154a	10425abcd	9502bc	8092ab	11310abc	9635bc	5128a	4457a	5567a	5051a	8370a
11. (HYXWD)X(MBXHRC)	13577fg	11759b	16437a	13925ef	10707bc	12188d	14205bc	12367d	5015a	5729ab	7875abc	6207abc	10833a
12. Pioneer X304	11218def	11384ab	11143a	11249bcde	8907bc	9612abcd	10081ab	9533bc	5100a	5026a	5405a	5177ab	8653a
13. Pioneer 3175	8459abc	7567a	11668a	9231ab	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	7644ab	7613a	9986a	8414a	-	-	-	-	-	-	-	-	-
15. IXL 9	6896a	7824ab	10752a	8491a	5394a	7035a	8819a	7082a	-	-	-	-	-
Mean	11282	11520	13887	12949	9591	9838	12387	10926	5477	6296	7447	6407	11937

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 14. Stover Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting, Plants Per Hectare			May	July Planting, Plants Per Hectare			July	September Planting, Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	17096g*	14734cd	16087e	15972f	15957d	17240c	13830d	15676g	12132de	11080d	13651d	12288f	14645f
2. H R C	15886fg	9600bc	10283bcd	11923c	9730c	9701ab	10018bcd	9816def	-	-	-	-	-
3. Mayorbella	10856de	9480bc	8906abcd	9747b	6535abc	9501ab	8417abc	8151bcde	5757ab	5896ab	7218abc	6290abc	8063bc
4. Hawaiian Yellow	8579bcd	16564d	12762de	12635cd	4574a	6674a	5233a	5494a	3593a	4369a	4863a	4275a	7468ab
5. WD X HRC	17830g	15562cd	12849de	15414e	7995abc	12069b	9675bc	9913ef	14099e	8942bcd	11873d	11638f	12321e
6. WD X MB	12897ef	15728cd	12805de	13810cde	7612abc	12024b	12190cd	10608f	7106abc	8667bcd	11348cd	9041de	11153e
7. WD X HY	13195ef	13463bcd	11789cd	12815cd	7663abc	7077a	6977ab	7239abc	6051ab	6698abc	6514ab	6421abc	8825bcd
8. MB X HRC	17419g	13574bcd	11537cd	14177def	8682bc	11712b	8201abc	9532def	10477cd	10042cd	10808bcd	10443ef	11384e
9. HRC X HY	14351fg	11885cd	9026abcd	11754c	6709abc	10224ab	7774ab	8236cde	8823bcd	6480abc	9297abcd	8200cd	9396d
10. MB X HY	8240bcd	10305c	6591ab	8378b	4944ab	7162a	5923ab	6010ab	4534a	5751ab	6075a	5454ab	6614a
11. (HYXWD)(MBXHRC)	16116fg	11815cd	8104abc	12012cd	7289abc	8711ab	9592abc	8530cdef	6656ab	6492abc	6591ab	6580bc	8865cd
12. Pioneer X304	9147cd	9847bc	6719ab	8571b	7201abc	7646a	7888abc	7578abcd	3429a	4714a	5309a	4484ab	6878ab
13. Pioneer 3175	5578ab	5860ab	5909a	5782a	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	6497abc	4549a	5773a	5606a	-	-	-	-	-	-	-	-	-
15. IXL 9	4280a	4773a	6472ab	5175a	-	-	-	-	-	-	-	-	-
Mean	11864	11182	9707	12299	7907	9978	8810	8815	7514	7194	8504	7689	10557

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 15. Stover Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	Means Over Dates
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	
1. Waimea Dent	9553ab*	12477ab	16649d	12893cd	3769ab	6852b	6683bcde	5768cde	9330cd
2. H R C	10355ab	9626ab	14714d	11565abcd	5350ab	4639b	7562def	5850cde	8707bcd
3. Mayorbella	7647a	9025ab	8649ab	8440a	3708ab	4032b	4530abc	4090abcd	6265a
4. Hawaiian Yellow	7678a	12677ab	10058bc	10138ab	3529a	5781b	5390bcd	4900bcde	7519ab
5. WD X HRC	10294ab	12562ab	16392d	13083cd	5369ab	5027b	9956b	6784e	9933d
6. WD X MB	9778ab	11562ab	12271c	11204abcd	5575ab	5550b	8317ef	6480de	8842bcd
7. WD X HY	8219a	8740ab	10524bc	9161a	4819ab	4378b	9119ef	6105cde	7633ab
8. MB X HRC	12857b	11833ab	16107d	13599cd	7171b	5061b	7660ef	6630e	10115d
9. HRC X HY	10072ab	7322a	9348ab	8914a	4897ab	4960b	4778abc	4878bcde	6896a
10. MB X HY	8953ab	12860ab	9609ab	10474abc	3891ab	7265b	4641abc	5266cde	7870abc
11. (HYXWD)(MBXHRC)	10734ab	14545b	12130c	12470bcd	4700ab	4895b	7330cdef	5642cde	9056bcd
12. Pioneer X304	6687a	10770ab	9325ab	8927a	3095a	5220b	5341bcd	4552abcde	6740a
13. Pioneer 3175	8753ab	9735ab	7315a	8601a	3534a	5373b	2756ab	3888abc	6244a
14. Pioneer 3306	9046ab	8195ab	7519a	8253a	3699ab	3198a	3069ab	3322ab	5787a
15. IXL 9	7223a	9936ab	7548a	8236a	3316a	3380a	2036a	2910a	5573a
Mean	9190	10791	11210	10397	4428	5041	5944	5137	7767

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 16. Stover Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	10007b*	10164bc	10967ab	10379cd	15062c	14351c	14523c	14645f	12534c	12258e	12745e	12512f
2. Mayorbella	6790a	8133ab	8883b	7935a	7716ab	8292a	8180a	8063bc	7253a	8213ab	8531ab	7999ab
3. Hawaiian Yellow	8431ab	8534ab	12077b	9681bc	5582a	9202a	7619a	7468ab	7006a	8868abc	9848bc	8574c
4. WD X HRC	11761c	11850c	13344b	12318e	13308bc	12191b	11466b	12321e	12534c	12020e	12405de	12320f
5. WD X MB	8928b	9702b	11330ab	9986cd	9205b	12139b	12114bc	11153e	9066b	10921de	11722cde	10570de
6. WD X HY	9590b	9181ab	13077b	10616cd	8969b	9079a	8427a	8825bcd	9280b	9130abc	10752cde	9721cd
7. MB X HRC	9009b	10569bc	13402b	10993d	12193c	11776b	10182ab	11384e	10601b	11172de	12233de	11188e
8. HRC X HY	9726b	10746bc	12446b	10972d	9961b	9530a	8699a	9396d	9843b	10138cd	10572cd	10184d
9. MB X HY	8115ab	7652a	9343b	8370a	5906a	7739a	6196a	6614a	7011a	7696a	7770a	7492a
10. (HYXWD)(MBXHRC)	9766b	9892bc	12839b	10833cd	10020b	9006a	7570a	8865cd	9893b	9449bc	10550cd	9849d
11. Pioneer X304	8408ab	8674ab	8877a	8653ab	6592a	7402a	6639a	6878ab	7500a	8038ab	7758a	7765ab
Mean	9139	9554	11588	10094	9501	10064	9300	9601	9320	9809	10413	9847

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 17. Stover Yield of Corn (kg/ha, dry weight) as Influenced by Plant Population at Two Dates of Planting and Three Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Volcano Plants Per Hectare			Volcano	Means Over Locations Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	11949bc*	11728abc	11602abc	11759bc	16526d	15987e	14958d	15824e	6661ab	9664a	11666cde	9330cd	11712d	12460d	12742cd	12305e
2. Mayorbella	8247a	9774ab	10123a	9381a	8695ab	9490ab	8661abc	8949bc	5677ab	6529a	6589a	6265a	7540a	8598a	8458a	8196a
3. Hawaiian Yellow	10154a	10119ab	14748bcd	11674bc	6576a	11619bcd	8997abc	9064bc	5604ab	9229a	7724ab	7519ab	7445a	10323abc	10490b	9419b
4. WD X HRC	13725c	13545c	15600d	14290c	12913c	13815de	11262bc	12663d	7832b	8794a	13174	9933d	11490cd	12051cd	13345d	12295e
5. WD X MB	10399ab	11316abc	13167abcd	11627bc	10254bc	13876de	12497cd	12209d	7676b	8556a	10294bcd	8842bcd	9443b	11249bcd	11986bcd	10893cd
6. WD X HY	11732bc	11074abc	15694d	12833c	10429bc	10270abc	9383abc	10027c	6519ab	6559a	9821bc	7633ab	9560b	9301abc	11633bcd	10164bc
7. MB X HRC	10966abc	10550ab	15698d	12238c	13051c	12643cd	9869abc	11854d	10014c	8447a	11883de	10115d	11344cd	10547bc	1248ecd	11402de
8. HRC X HY	11686bc	13189bc	15121cd	13332c	10530bc	11055abc	8400abc	9995c	7484b	6141a	7063a	6896a	9900bc	10128abc	10194b	10074bc
9. MB X HY	9609a	9249a	11232ab	10030ab	6592a	8733a	6257a	7194a	6422ab	10062a	7125a	7870abc	7541a	9348abc	8205a	8365a
10. (HYXWD)(MBXHRC)	12142bc	11974abc	15321cd	13146c	11702c	10263abc	8848abc	10271c	7717b	9720a	9730bc	9056bcd	10520bcd	10652bc	11300bc	10824cd
11. Pioneer X304	10062a	10498ab	10612a	10391ab	8174ab	8747a	7303ab	8075ab	4891a	7995a	7333a	6740a	7709a	9080ab	8416a	8402a
Mean	10970	11183	13658	11937	10495	11500	9676	10557	6954	8336	9309	8199	9473	10340	10881	1023

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 18. Ear Length of Corn (cm) as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	18.85abcd*	21.71bc	18.79abc	19.79defg	19.81bcd	16.44abc	18.35b	18.20bc	16.05bc	16.12bc	14.40ab	15.41cd	17.80b
2. H R C	17.20a	20.25bc	17.78ab	18.41ab	-	-	-	-	-	-	-	-	-
3. Mayrobella	18.28abc	19.05ab	18.09abc	18.47abc	17.90ab	16.82bc	16.13ab	16.95bc	15.02b	14.55ab	12.85a	14.08ab	16.50a
4. Hawaiian Yellow	19.62abcd	19.43bc	19.43abc	19.49cdefg	18.16abc	16.70bc	17.14ab	17.33bc	16.75bcd	16.25bc	14.50ab	15.83cd	17.55b
5. WD X HRC	20.51bcd	21.27bc	18.92abc	20.23fghi	18.28abc	15.81ab	16.19ab	16.76b	18.02d	16.02bc	16.25bc	16.75de	17.91b
6. WD X MB	19.24abcd	19.62bc	17.65a	18.83abcd	19.30bcd	16.89bc	17.27ab	17.82bc	13.10a	13.60a	13.87ab	13.41a	16.69a
7. WD X HY	20.82cd	20.38bc	19.87abc	20.36ghi	19.87bcd	16.44abc	16.51ab	17.61bc	16.77bcd	16.05bc	15.07ab	15.91cd	17.96b
8. MB X HRC	19.49abcd	19.62bc	18.22abc	19.11bcde	18.16abc	17.90cd	16.89ab	17.65bc	15.25b	17.27c	15.27ab	15.91cd	17.56b
9. HRC X HY	17.71abcd	19.74bc	17.84abc	18.43ab	16.63a	14.92a	15.49a	15.68a	15.50b	15.27abc	14.75ab	15.16bc	16.42a
10. MB X HY	18.98ab	20.06bc	18.66ab	19.23bcdef	20.00cd	17.46bcd	17.08ab	18.18bc	15.75bc	16.00bc	15.50ab	15.75cd	17.72b
11. (HYXWD)X(MBXHRC)	19.11abcd	20.89bc	18.85abc	19.62defg	19.24bcd	16.31abc	16.57ab	17.37bc	15.00b	14.50ab	16.02b	15.16bc	17.38b
12. Pioneer X304	21.08cd	21.59bc	20.12bc	20.93hi	20.25d	18.60cd	17.01ab	18.62c	17.50cd	17.50c	18.75c	17.91e	19.16c
13. Pioneer 3175	21.46d	21.84c	20.32c	21.20i	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	18.66abcd	17.52a	17.65a	17.95a	-	-	-	-	-	-	-	-	-
15. IXL 9	20.51bcd	20.19bc	19.68abc	20.13efgh	16.69a	18.92d	17.20ab	17.60bc	-	-	-	-	-
Mean	19.43	20.30	18.77	19.50	18.87	16.75	16.78	17.47	15.86	15.70	15.15	15.57	17.51

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 19. Ear Length of Corn (cm) as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	22.16a*	19.30bc	17.46a	19.64b	12.00a	14.79bcd	15.30b	14.03b	13.14abcd	12.63ab	12.12ab	12.63bc	15.43b
2. H R C	21.08a	17.71ab	17.71a	18.84b	13.14abc	14.66bc	15.49b	14.43b	-	-	-	-	-
3. Mayorbella	19.49a	20.00c	17.91a	19.13b	12.25ab	14.09b	12.12a	12.82a	12.19ab	11.94a	11.87ab	12.00ab	14.65a
4. Hawaiian Yellow	19.68a	19.04bc	16.95a	18.56b	16.76de	17.33efg	16.06b	16.72d	15.43ef	14.48cd	13.46bc	14.45ef	16.58cd
5. WD X HRC	22.09a	20.44c	17.97a	20.17b	15.43cde	16.32cdefg	16.19b	15.98cd	13.84bcde	13.90bcd	12.57ab	13.43cde	16.53cd
6. WD X MB	21.14a	20.63c	17.59a	19.79b	12.12a	11.55a	11.81a	11.83a	11.74a	11.55a	10.98a	11.42a	14.35a
7. WD X HY	20.63a	20.06c	17.39a	19.36b	15.42cde	16.25cdefg	15.74b	15.81cd	14.73cdef	13.39bc	13.58bc	13.90def	16.36c
8. MB X HRC	21.46a	19.30bc	14.35a	18.37b	14.67bcd	15.74bcdef	14.73b	15.05bc	12.70abc	13.97bcd	12.82ab	13.16cd	15.53b
9. HRC X HY	21.46a	19.17bc	17.01a	19.21b	15.74de	16.51defg	15.87b	16.04cd	12.95abc	14.03bcd	13.52bc	13.50cdef	16.25c
10. MB X HY	19.94a	19.43bc	17.40a	18.92b	15.81de	17.46fg	16.06b	16.44d	15.05def	14.98de	13.46bc	14.49f	16.62cd
11. (HYXWD)(MBXHRC)	21.33a	20.31c	17.65a	19.77b	15.81de	15.62bcde	16.06b	15.83cd	15.05def	14.60cd	13.20b	14.28ef	16.29c
12. Pioneer X304	21.71a	20.63c	13.65a	18.66b	17.71e	17.78g	15.81b	17.10d	16.13f	16.13e	15.24c	15.83g	17.20d
13. Pioneer 3175	21.21a	19.43bc	18.41a	19.68b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	17.52a	16.32a	16.31a	16.72a	-	-	-	-	-	-	-	-	-
15. IXL 9	19.43a	18.79bc	17.02a	18.41b	-	-	-	-	-	-	-	-	-
Mean	20.01	19.85	16.85	19.23	14.88	15.77	15.07	15.24	13.90	13.78	12.71	13.46	17.24

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 20. Ear Length of Corn (cm) as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting			May	July Planting			July	Means
	Plants Per Hectare				Plants Per Hectare				Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	19.55abc*	21.08bc	21.59bcd	20.74bcd	19.17a	18.98a	19.93b	19.36b	20.05ab
2. H R C	20.38abc	20.82abc	20.06bcd	20.42bcd	20.19a	19.17a	19.05b	19.47b	19.94ab
3. Mayorbella	19.05ab	20.70abc	19.49abc	19.74abc	17.84a	18.16a	18.92b	18.30ab	19.02a
4. Hawaiian Yellow	19.36ab	20.95abc	19.68bcd	20.00bcd	19.62a	19.74a	18.85b	19.40b	19.70ab
5. WD X HRC	19.93abc	21.46c	19.30bcd	20.23bcd	20.32a	19.62a	19.74b	19.89b	20.06ab
6. WD X MB	21.84c	21.14bc	21.33d	21.44d	20.44a	19.43a	19.74b	19.87b	20.65b
7. WD X HY	18.92ab	19.81ab	20.63bcd	19.79bcd	18.73a	18.54a	18.28ab	18.52ab	19.15ab
8. MB X HRC	19.87abc	19.43a	21.65bcd	20.32bcd	20.00a	18.35a	19.74b	19.36b	19.84ab
9. HRC X HY	19.55abc	20.51abc	18.85ab	19.64ab	19.43a	19.62a	19.36b	19.47b	19.55ab
10. MB X HY	20.12abc	20.38abc	18.22ab	19.57ab	17.90a	19.93a	18.16ab	18.66ab	19.12ab
11. (HYXWD)(MBXHRC)	20.70abc	20.19abc	21.33bcd	20.74bcd	20.25a	17.78a	19.68b	19.24b	19.99ab
12. Pioneer X304	21.20bc	19.81ab	20.76bcd	20.59bcd	20.57a	19.36a	19.49b	19.81b	20.20ab
13. Pioneer 3175	20.57abc	20.76abc	22.66cd	21.33cd	18.79a	20.57a	19.74b	19.70b	20.51b
14. Pioneer 3306	20.51abc	20.00abc	19.43bcd	19.98bcd	19.93a	19.49a	17.84ab	19.09b	19.53ab
15. IXL 9	18.60a	20.06abc	17.20a	18.62a	18.22a	18.47a	16.31a	17.67a	18.14
Mean	20.01	20.47	20.15	20.31	19.43	19.15	18.99	19.19	19.75

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 21. Ear Length of Corn (cm) as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	18.22abc*	18.05a	17.13b	17.80b	15.76bc	15.53b	14.96ab	15.43b	16.99cde	16.81bc	16.04bc	16.62bc
2. Mayorbella	17.06ab	16.79a	15.65a	16.50a	14.64a	15.34b	13.97ab	14.65a	15.85a	16.06a	14.81a	15.58a
3. Hawaiian Yellow	18.17abc	17.46a	17.02b	17.55b	17.29d	16.95c	15.49b	16.58cd	17.73ef	17.20cd	16.26bc	17.06d
4. WD X HRC	18.93bcd	17.69a	17.12b	17.91b	17.12d	16.89c	15.57b	16.53cd	18.02f	17.29cd	16.35c	17.22d
5. WD X MB	17.08abc	16.67a	16.22ab	16.69a	15.00ab	14.58a	13.46a	14.35a	16.09ab	15.62a	14.84a	15.52a
6. WD X HY	19.15cd	17.61a	17.12b	17.96b	16.93d	16.57c	15.57b	16.36c	18.04f	17.09bcd	16.35c	17.16d
7. MB X HRC	17.63abc	18.25ab	16.78ab	17.56b	16.27cd	16.34c	13.97ab	15.53b	16.95cd	17.29cd	15.37ab	16.54bc
8. HRC X HY	16.61a	16.64a	16.02ab	16.42a	16.72cd	16.57c	15.47b	16.25c	16.66bc	16.60b	15.75bc	16.34b
9. MB X HY	18.24abc	17.84a	17.08b	17.72b	16.93d	17.29c	15.64b	16.62cd	17.59def	17.56d	16.36c	17.17d
10. (HYXWD)(MBXHRC)	17.78abc	17.23a	17.14b	17.38b	17.39d	16.84c	14.62ab	16.29c	17.59def	17.04bcd	16.66c	16.83cd
11. Pioneer X304	19.61d	19.23b	18.63c	19.16c	18.52e	18.18d	14.90ab	17.20d	19.06g	18.70e	16.76c	18.18e
Mean	18.05	17.59	16.90	17.51	16.60	16.46	15.02	15.98	17.32	17.03	15.89	16.74

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 22. Ear Length of Corn (cm) as Influenced by Plant Population at Two Dates of Planting and Three Locations

Varieties	Waimanalo			Waimanalo	Kauai			Kauai	Volcano			Volcano	Means Over Locations			Variety
	Plants Per Hectare				Plants Per Hectare				Plants Per Hectare				Plants Per Hectare			
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44.460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	19.33bc*	19.83bc	18.57b	18.99c	17.08abc	17.05b	16.38a	16.83bcd	19.36ab	20.03a	20.76b	20.05ab	18.59b	18.72a	18.57a	18.63b
2. Mayorbella	18.09ab	17.93ab	17.11ab	17.71ab	15.87a	17.04b	15.01a	15.98ab	18.44a	19.43a	19.20ab	19.02a	17.47a	18.13a	17.11a	17.57a
3. Hawaiian Yellow	18.89bc	18.06	18.28b	18.41bc	18.22cd	18.19c	16.51a	17.64cd	19.49ab	20.35a	19.27ab	19.70ab	18.86b	18.87a	18.02a	18.58b
4. WD X HRC	19.39bc	18.54ab	17.55ab	18.49bc	18.76de	18.38cd	17.08a	18.07d	20.13ab	20.54a	19.52ab	20.06ab	19.43b	19.15ab	18.05a	18.88bc
5. WD X MB	19.27bc	18.25ab	17.46ab	18.33bc	16.63ab	16.09a	14.70a	15.81a	21.14b	20.28a	20.54b	20.65b	19.01b	18.21a	17.56a	18.26b
6. WD X HY	20.35bc	18.41ab	18.19b	18.98c	18.03cd	18.16c	16.57a	17.58cd	18.82ab	19.17a	19.46ab	19.15ab	19.17b	18.58a	18.07a	18.57b
7. MB X HRC	18.82bc	18.76b	17.55ab	18.38bc	18.06cd	17.52bc	14.54a	16.71abc	19.93ab	18.89a	20.70b	19.84ab	18.94b	18.39a	17.60a	18.31b
8. HRC X HY	17.17a	17.33a	16.66a	17.06a	18.60de	17.84bc	16.44a	17.63cd	19.49ab	20.06a	19.11ab	19.55ab	18.42b	18.41a	17.40a	18.08ab
9. MB X HY	19.49bc	18.76b	17.87b	18.71c	17.87bcd	18.44cd	16.73a	17.68cd	19.01ab	20.16a	18.19a	19.12ab	18.79b	19.12ab	17.59a	18.50b
10. (HYXWD)(MBXHRC)	19.17bc	18.60b	17.71ab	18.49bc	18.57de	17.97bc	16.86a	17.80d	20.47ab	18.98a	20.51b	19.99ab	19.41b	18.52a	18.36a	18.76bc
11. Pioneer X304	20.67c	20.10c	18.57b	19.78d	19.71e	19.21d	14.73a	17.88d	20.89ab	19.59a	20.13b	20.20ab	20.42c	19.63b	17.81a	19.29c
Mean	19	18	17	18.48	17.95	17.81	15.96	17.24	19.74	19.77	19.76	19.76	18.95	18.70	17.83	18.82

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 23. Days to Tasseling of Corn as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over Dates
	34.580	44.460	54,340	Means	34.580	44,460	54,340	Means	34,580	44,460	54,340	Means	
1. Waimea Dent	55g*	54def	55efg	55e	52efg	55d	54de	54d	58ef	58d	53ab	56e	55d
2. H R C	57h	57g	58h	57h	-	-	-	-	-	-	-	-	-
3. Mayorbella	51bcd	51bc	51bc	51c	48bc	48ab	48ab	48b	53bc	52abc	52ab	52bc	50a
4. Hawaiian Yellow	50	51bc	51bc	51bc	48bc	48ab	48abc	48b	50a	51a	50a	50a	50a
5. WD X HRC	57h	56fg	56g	56g	55h	57e	56e	56e	61f	62e	60b	61f	58e
6. WD X MB	52cde	54d	54de	53d	51def	50c	50bc	50c	54c	53bc	53ab	53cd	52c
7. WD X HY	53ef	54de	54ef	54d	50de	50bc	51c	50c	55cd	54e	53ab	54d	53c
8. MB X HRC	55g	56ef	56g	56fg	53g	54d	53d	54d	57de	59d	55b	57e	55d
9. HRC X HY	54fg	55def	56fg	55ef	52fg	54d	53d	53d	59ef	57d	55b	57e	55d
10. MB X HY	51bcd	51bc	52bc	51c	48b	47a	48abc	48b	51ab	51ab	50a	51ab	50a
11. (HYXWD)X(MBXHRC)	53def	54d	54ef	53d	50cde	49bc	50bc	50c	54c	53bc	52ab	53cd	52a
12. Pioneer X304	50bc	52c	52cd	51c	49bcd	50c	51c	50c	53bc	53bc	53ab	53cd	51b
13. Pioneer 3175	50b	50b	50b	50b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	47a	48a	48a	48a	-	-	-	-	-	-	-	-	-
15. IXL 9	47a	47a	48a	47a	46a	47a	47a	47a	-	-	-	-	-
Mean	52	52	53	52	50	51	51	51	55	55	53	54	53

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 24. Days to Tasseling of Corn as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting			May	July Planting			July	September Planting			Sept.	Means
	Plants Per Hectare				Plants Per Hectare				Plants Per Hectare				Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	59de*	63cde	64b	62bc	64b	64b	64bc	64e	64ab	63ab	65bc	64d	63d
2. H R C	61e	61bcd	62ab	61bc	71d	65b	67c	68f	-	-	-	-	-
3. Mayorbella	57cd	62bcde	62ab	60bc	62ab	58a	58a	59ab	62a	62a	62ab	62ab	60ab
4. Hawaiian Yellow	57cd	64ef	69b	63c	59a	58a	61ab	59ab	61a	61a	61a	61a	61abc
5. WD X HRC	60de	66f	66b	64c	67c	64b	67c	66f	68b	65b	67c	66c	65e
6. WD X MB	59de	63def	66b	63bc	64b	58a	61ab	61bc	64ab	61a	63abc	63abcd	62bcd
7. WD X HY	59de	65ef	68b	64c	64b	64b	64bc	64e	61a	63ab	62ab	62ab	63cd
8. MB X HRC	60de	62bcde	63b	61bc	64b	64b	64bc	64e	62a	63ab	65bc	63bcd	63cd
9. HRC X HY	59de	62bcde	62ab	61bc	64b	64b	62ab	63de	65ab	62a	65bc	64cd	62cd
10. MB X HY	57cd	61bcd	62ab	60bc	61ab	58a	58a	59a	61a	62a	61a	61a	60a
11. (HYXWD)X(MBXHRC)	59de	62bcde	62ab	61bc	64b	59a	62ab	62cd	61a	61a	63ab	61ab	59a
12. Pioneer X304	59de	62bcde	51a	57ab	59a	59a	58a	59a	63a	61a	63ab	62abc	59a
13. Pioneer 3175	55bc	60abc	60ab	58abc	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	53ab	59ab	59ab	57ab	-	-	-	-	-	-	-	-	-
15. IXL 9	52a	57a	57ab	55a	-	-	-	-	-	-	-	-	-
Mean	57	62	62	60	63	61	62	62	63	62	63	63	62

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 25. Days to Tasseling of Corn as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare 34,580	44,460	54,340	Waimanalo Means	Kauai Plants Per Hectare 34,580	44,460	54,340	Kauai Means	Means Over Location Plants Per Hectare 34,580	44,460	54,340	Variety Means
1. Waimea Dent	55d*	56c	54cd	55d	62c	63b	64c	63d	58e	59f	59de	59c
2. Mayorbella	51b	50a	50ab	50a	60abc	60a	60abc	60ab	56bc	55ab	55ab	55a
3. Hawaiian Yellow	49a	50a	50a	50a	59a	61a	63bc	61abc	59a	55abc	57bc	55a
4. WD X HRC	58e	58d	57e	58e	65d	65c	67c	65e	61f	62g	62f	61d
5. WD X MB	52c	52b	52b	52c	62c	60a	63c	62bcd	57d	56d	58cde	57b
6. WD X HY	53c	52b	53bc	53c	61bc	64bc	64c	63cd	57d	58e	58cde	58ab
7. MB X HRC	55d	56c	55d	55d	62c	63b	64c	63cd	59e	59f	59e	59c
8. HRC X HY	55d	55c	55d	55d	62c	62b	63c	62cd	59e	59ef	59de	59bc
9. MB X HY	50ab	50a	50a	50a	59ab	60a	60abc	60a	55ab	55a	55ab	55a
10. (HYXWD)(MBXHRC)	52c	52b	52b	52c	61bc	60a	57a	59a	57cd	56cd	57bcd	56a
11. Pioneer X304	51b	51b	52b	51b	60abc	61a	57ab	59a	55bc	56bcd	54a	55a
Mean	53	53	53	53	61	62	62	62	57	57	57	57

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 26. Days to Silking of Corn as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	61g*	59fg	60d	60f	60h	61e	61f	60f	71e	72e	73e	72f	64g
2. H R C	60g	61h	62e	61g	-	-	-	-	-	-	-	-	-
3. Mayorbella	55d	55c	54b	54c	55cd	55bc	54bc	54c	61bc	61bc	66cd	62cd	57c
4. Hawaiian Yellow	53bc	53bc	54b	53b	52b	53b	53ab	53b	54a	54a	54a	54a	53a
5. WD X HRC	60g	60gh	61de	60g	60h	61e	60ef	60f	67d	70e	66cd	68e	63f
6. WD X MB	56e	58def	57c	57d	57fg	59e	59ef	58e	67d	70e	68d	68e	61e
7. WD X HY	57e	57de	58c	57d	56ef	56cd	56cd	56d	61bc	63cd	64c	63cd	59d
8. MB X HRC	58f	59ef	60d	59e	59gh	59e	58de	59e	63cd	65d	65cd	64d	61e
9. HRC X HY	58f	59ef	60d	59e	55cde	57d	56cd	56d	63cd	63cd	63bc	63d	59d
10. MB X HY	54cd	54bc	54b	54c	52b	53b	54bc	53b	55ab	56a	54a	55ab	54ab
11. (HYXWD)X(MBXHRC)	56e	56d	57c	56d	54bc	56cd	56c	55cd	61bc	60bc	60b	61c	57c
12. Pioneer X304	54c	54bc	55b	54c	53b	53b	54b	53b	58ab	57ab	56a	57b	55b
13. Pioneer 3175	52b	53b	53b	53b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	50a	50a	51a	50a	-	-	-	-	-	-	-	-	-
15. IXL 9	50a	50a	51a	50a	49a	50a	51a	50a	-	-	-	-	-
Mean	55	56	56	56	55	56	56	56	62	63	63	63	58

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 27. Days to Silking of Corn as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting			May	July Planting			July	September Planting			Sept.	Means
	Plants Per Hectare				Plants Per Hectare				Plants Per Hectare				Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	70g*	74fg	78c	74de	74cd	72b	72c	73g	76de	75de	76de	75de	74f
2. H R C	71h	67bcd	68abc	69bcd	76d	72b	73c	73g	-	-	-	-	-
3. Mayorbella	62bc	68cde	65abc	65abc	69ab	65a	67ab	67bc	70abc	71bcd	69ab	70b	67bc
4. Hawaiian Yellow	62bc	75g	77c	71de	67ab	64a	67ab	66ab	68ab	68ab	66a	67a	68cd
5. WD X HRC	69g	73fg	74bc	72de	73cd	71b	73c	72fg	78e	77e	77e	77e	74f
6. WD X MB	63cde	71efg	74bc	69d	71bc	71b	69bc	70de	72cd	71bcd	72bcd	72bc	70de
7. WD X HY	63bcd	73fg	72bc	69cd	71bc	71b	71bc	71ef	70abc	71bcd	70ab	70b	70de
8. MB X HRC	66ef	68cde	72bc	69bcd	71bc	71b	70bc	70ef	73cd	73cde	74cde	73cd	71e
9. HRC X HY	68fg	69cde	71bc	69cd	71bc	71b	69bc	70de	61bc	70abc	71bc	71b	70de
10. MB X HY	62bc	65abc	67abc	64ab	67ab	64a	64a	65a	68ab	67a	66a	67a	65ab
11. (HYXWD)X(MBXHRC)	65def	70def	69bc	68bcd	71bc	65a	69bc	68cd	68ab	71bcd	70ab	69b	67abc
12. Pioneer X304	63bcd	67bcd	55a	61a	65a	65a	64a	65a	67a	68ab	67a	67a	64a
13. Pioneer 3175	61abc	63ab	65abc	63a	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	60ab	63a	63ab	62a	-	-	-	-	-	-	-	-	-
15. IXL 9	59a	62a	62ab	61a	-	-	-	-	-	-	-	-	-
Mean	64	68	69	68	70	68	69	69	71	71	71	71	69

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 28. Days to Silking of Corn as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting: Plants Per Hectare			May	July Planting: Plants Per Hectare			July	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	110ab*	115cd	115bcd	113abc	103a	110a	110efg	108b	110a
2. H R C	116ab	125cd	119g	102c	105a	114a	115g	107b	104a
3. Mayorbella	110ab	108ab	114bc	111abc	100a	100a	104cdef	101ab	106a
4. Hawaiian Yellow	107ab	114bcd	112b	111abc	97a	104a	98abcd	100ab	105a
5. WD X HRC	115ab	116cd	120efg	117bc	101a	108a	108cdefg	106b	111a
6. WD X MB	116ab	114bcd	117cde	115abc	101a	103a	102cde	102ab	109a
7. WD X HY	113ab	109ab	115bcd	112abc	103a	98a	98bcde	100ab	106a
8. MB X HRC	120b	106a	124fg	117bc	109a	102a	111fg	107b	112a
9. HRC X HY	116ab	113bcd	125g	118c	105a	100a	109cdefg	105ab	111a
10. MB X HY	114ab	118d	113bc	115abc	97a	105a	100bcde	101ab	108a
11. (HYXWD)(MBXHRC)	108ab	106a	119defg	111abc	107a	98a	102cde	102ab	107a
12. Pioneer X304	105a	112bc	114bc	110abc	97a	102a	102cde	100ab	105a
13. Pioneer 3175	111ab	109ab	104a	108ab	98a	104a	96abc	99ab	103a
14. Pioneer 3306	112ab	109ab	101a	107a	102a	102a	92ab	98ab	102a
15. IXL 9	104a	112bc	105a	107a	93a	100a	90a	94a	100a
Mean	112	112	118	114	101	103	102	102	108

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 29. Days to Silking of Corn as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	64f*	64h	64f	64g	73d	73f	75b	74f	69d	69g	70ef	69e
2. Mayorbella	57b	57bc	58bc	57c	67ab	68bc	67ab	67bc	62b	62cd	62abc	62b
3. Hawaiian Yellow	53a	53a	54a	53a	65a	69bcd	70b	68cd	59a	61c	62ab	61a
4. WD X HRC	62e	64h	62e	63f	73d	73f	75b	74f	68d	68g	68ef	68de
5. WD X MB	60d	62g	61e	61e	69bc	71e	72b	70de	64c	66f	66ef	66d
6. WD X HY	58bc	59de	59cd	59d	68b	72ef	71b	70de	63b	65e	65dc	64c
7. MB X HRC	60d	61fg	61de	61e	70c	71de	72b	71e	65c	66f	66de	66d
8. HRC X HY	59cd	60ef	59cd	59d	70c	70cde	70b	70de	64c	65e	65cde	65cd
9. MB X HY	54a	54ab	54a	54ab	65a	65a	65ab	65ab	60a	60b	60a	60a
10. (HYXWD)(MBXHRC)	57bc	57cd	57b	57c	68b	69cd	63a	67abc	62b	63d	63bcd	62b
11. Pioneer X304	55a	55ab	55a	55b	65a	67ab	62a	64a	60a	61a	58ab	59a
Mean	58	59	59	58	68	70	70	69	63	64	64	64

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 30. Days to Silking of Corn as Influenced by Plant Population at Two Dates of Planting and Three Locations

Varieties	Waimanalo Plants Per Hectare 34,580	44,460	54,340	Waimanalo Means	Kauai Plants Per Hectare 34,580	44,460	54,340	Kauai Means	Volcano Plants Per Hectare 34,580	44,460	54,340	Volcano Means	Means Over Locations Plants Per Hectare 34,580	44,460	54,340	Variety Means
1. Waimea Dent	60e*	60fg	60f	60g	72e	73f	75b	73e	107a	112a	112cde	110a	80d	82c	82e	81g
2. Mayorbella	55b	55b	54a	54b	65ab	67abc	66ab	66b	105a	104a	109abc	106a	75ab	75a	76ab	75abc
3. Hawaiian Yellow	53a	53a	53a	53a	64a	69cde	72b	68c	102a	109a	105a	105a	73a	77ab	77abc	76abc
4. WD X HRC	60e	60g	60f	60g	71e	72ef	73b	72de	108a	112a	114de	111a	80d	81bc	82e	81g
5. WD X MB	57c	58e	58de	58e	67bc	71ef	71b	70c	108a	108a	109abcd	109a	77bcd	79abc	79cde	79def
6. WD X HY	56c	57cd	57bc	57d	67bc	72ef	71b	70cd	108a	103a	107ab	106a	77bcd	77ab	78bc	77cde
7. MB X HRC	58d	59ef	59e	59f	68cd	69de	71b	69c	115a	104a	117e	112a	80d	77ab	82e	80fg
8. HRC X HY	57c	58de	58cd	57e	69d	70de	70b	70c	111a	107a	117e	111a	79cd	78abc	81de	79efg
9. MB X HY	53a	53ab	54a	53a	64a	64a	65ab	64ab	106a	112a	106ab	108a	74ab	76ab	75a	75ab
10. (HYXWD)(MBXHRC)	55b	56c	56b	56c	68cd	68bcd	69b	68c	108a	102a	111bcd	107a	77bc	75a	79bc	77bcd
11. Pioneer X304	53a	54ab	54a	54a	64a	66ab	59a	63a	101a	107a	108abc	105a	73a	76ab	74a	74a
Mean	56	57	57	57	65	70	70	68	107	107	110	108	77	78	79	78

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 31. Plant Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting, Plants Per Hectare			May	July Planting, Plants Per Hectare			July	September Planting, Plants Per Hectare			Sept.	Means Over Dates
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	
1. Waimea Dent	343f*	334gh	335d	337efg	322c	297b	316c	312d	246bcd	258c	266b	256de	302g
2. H R C	323def	322efg	331d	325de	-	-	-	-	-	-	-	-	-
3. Mayorbella	291bc	300de	299c	297c	297bc	281b	293c	290cd	232abcd	235ab	242ab	236b	274b
4. Hawaiian Yellow	345f	326fg	333d	335ef	283bc	277b	292c	284bc	253d	244bc	259b	252cde	290de
5. WD X HRC	349f	350h	353ef	351g	313bc	283b	294c	297cd	249cd	243bc	243ab	245bcd	297efg
6. WD X MB	314cdef	312def	331d	319d	287bc	268b	285b	280bc	233abcd	234ab	249ab	238b	279bc
7. WD X HY	348f	338gh	360f	349fg	294bc	295b	301c	297cd	250d	253bc	256ab	253cd	299fg
8. MB X HRC	344f	330fgh	347def	340fg	301bc	287b	291c	293cd	229abc	248bc	250ab	242bc	292def
9. HRC X HY	332ef	350h	354ef	345fg	291bc	265b	283bc	280bc	226ab	254bc	249ab	243bc	289de
10. MB X HY	302bcde	317efg	342de	320d	289bc	283b	293c	288c	241bcd	234ab	259b	244bcd	284cd
11. (HYXWD)X(MBXHRC)	339f	352h	340de	343fg	305bc	293b	305c	301cd	252d	257c	264b	258e	301g
12. Pioneer X304	293bcd	295cde	298c	295c	273b	273b	250b	265b	213a	217a	233a	221a	260a
13. Pioneer 3175	275ab	276bc	257b	269b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	252a	250a	240a	247a	-	-	-	-	-	-	-	-	-
15. IXL 9	273ab	258ab	260b	264b	225a	204a	204a	211a	-	-	-	-	-
Mean	315	314	319	316	290	275	284	283	238	243	252	244	288

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 32. Plant Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over Dates
	34.580	44.460	54.340	Means	34.580	44,460	54.340	Means	34,580	44,460	54,340	Means	
1. Waimea Dent	293g*	278h	270e	280f	205bcd	255cd	236cd	232bcd	198bc	198ab	183ab	193cd	235gh
2. H R C	282fg	228cde	224bcde	245cd	198abcd	247abcd	240cd	228bc	-	-	-	-	-
3. Mayorbella	251de	251defg	240de	247cde	183a	228ab	201a	204a	182abc	179a	160a	173ab	208bc
4. Hawaiian Yellow	255de	263fgh	259de	259de	213d	236abc	240cd	230bc	186abc	201ab	187ab	192cd	227efg
5. WD X HRC	289fg	266gh	266de	274ef	213d	262d	251d	242d	205c	205b	190b	200d	239h
6. WD X MB	255de	270gh	255de	260de	186ab	224a	201a	204a	171ab	190ab	190b	184bc	216cd
7. WD X HY	266ef	255efgh	251de	257de	198abcd	251bcd	224bc	224bc	194bc	186ab	187ab	189cd	224def
8. MB X HRC	278fg	244defg	228cde	250cde	209cd	251bcd	202a	220b	179abc	190ab	183ab	184bc	218cde
9. HRC X HY	274efg	262fgh	247de	261de	205bcd	259cd	236cd	233cd	198bc	198ab	183ab	193cd	229fgh
10. MB X HY	243cd	236cdef	221bcd	233c	190abc	228ab	209ab	209a	163a	183ab	160a	168a	204ab
11. (HYXWD)X(MBXHRC)	274efg	262fgh	259de	265def	213a	236abc	240cd	230bc	194bc	186ab	186ab	189cd	223def
12. Pioneer X304	224bc	225cd	171a	207b	198abcd	228ab	201a	209a	175ab	190ab	167ab	177abc	198a
13. Pioneer 3175	205ab	190ab	194abc	196ab	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	186a	179a	183ab	183a	-	-	-	-	-	-	-	-	-
15. IXL 9	205ab	209bc	190abc	201b	-	-	-	-	-	-	-	-	-
Mean	252	241	230	241	201	242	223	222	186	191	179	184	220

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 33. Plant Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting			May	July Planting			July	Means
	Plants Per Hectare				Plants Per Hectare				Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	297ab*	311a	339ef	316c	275a	301a	327ef	301bcd	308a
2. H R C	319b	316a	331def	322c	287a	311a	321ef	306bcd	314
3. Mayorbella	289ab	294a	318cde	300bc	273a	287a	315ef	291bcd	296a
4. Hawaiian Yellow	297ab	320a	329def	315c	280a	306a	303def	297bcd	306a
5. WD X HRC	318b	333a	345f	332c	310a	320a	332f	320cd	326a
6. WD X MB	305ab	332a	315cd	317c	291a	318a	287cde	298bcd	308a
7. WD X HY	311b	299a	318cd	309c	304a	287a	301def	297bcd	303a
8. MB X HRC	323b	323a	320cde	322c	314a	315a	315ef	315cd	318a
9. HRC X HY	321b	325a	306bc	317c	311a	312a	311ef	311cd	314a
10. MB X HY	293ab	312a	289b	298bc	278a	304a	277bcd	286bcd	292a
11. (HYXWD)(MBXHRC)	303ab	302a	339ef	315c	292a	293a	336f	307bcd	311a
12. Pioneer X304	282ab	327a	304bc	304bc	274a	318a	297cdef	296bcd	300a
13. Pioneer 3175	292ab	315a	294b	300bc	279a	302a	272abc	284abc	292
14. Pioneer 3306	300ab	287a	259a	282ab	289a	279a	257ab	275ab	278
15. IXL 9	258a	294a	267a	273d	253a	281a	247a	260a	266
Mean	300	313	311	308	287	302	300	296	302

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 34. Plant Height of Corn (cm) as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	303e*	296de	306d	302g	232bc	243b	230e	235gh	268de	268e	270d	268d
2. Mayorbella	273ab	272ab	278b	274b	205a	219ab	200abc	208bc	239ab	239b	246ab	241b
3. Hawaiian Yellow	294de	283bcd	295c	290de	218a	233ab	228de	227efg	256c	261de	258bcd	258c
4. WD X HRC	304e	292cde	297cd	297efg	236c	245b	236e	239h	270e	266e	268d	268d
5. WD X MB	278bc	271ab	288bc	279bc	204a	228ab	215bcde	216cd	241b	252bcd	250abc	247b
6. WD X HY	297de	295de	306d	299fg	219ab	231ab	221bcde	224def	258cd	263de	263cd	261c
7. MB X HRC	291cde	288cde	296cd	292def	222ab	228ab	204bcd	218cde	256c	250bcd	258bcd	255c
8. HRC X HY	283bcd	290cde	295cd	289de	225abc	239b	222cde	229fgh	254c	259cde	265d	259c
9. MB X HY	277bc	278bc	298cd	284cd	199a	215a	196ab	204ab	238ab	247bc	247ab	244b
10. (HYXWD)(MBXHRC)	298de	301e	303d	301g	227abc	228ab	213bcde	223def	263cde	269e	264d	262c
11. Pioneer X304	260a	262a	260a	260a	199a	214a	180a	198a	229a	220a	238a	229a
Mean	287	284	293	288	217	229	215	220	252	257	253	254

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 35. Plant Height of Corn (cm) as Influenced by Plant Population at Two Dates of Planting and Three Locations

Varieties	Waimanalo Plants Per Hectare 34,580	Waimanalo 44,460	Waimanalo 54,340	Waimanalo Means	Kauai Plants Per Hectare 34,580	Kauai 44,460	Kauai 54,340	Kauai Means	Volcano Plants Per Hectare 34,580	Volcano 44,460	Volcano 54,340	Volcano Means	Means Over Locations Plants Per Hectare 34,580	Means Over Locations 44,460	Means Over Locations 54,340	Variety Means
1. Waimea Dent	332d*	316de	326c	325g	249c	266c	253cd	256gh	286a	306a	333cd	308a	289def	296a	304de	296ef
2. Mayorbella	294ab	291ab	296b	293b	217a	239abc	221b	226bc	281a	290a	316bc	296a	264ab	273a	278bc	272b
3. Hawaiian Yellow	314bcd	302bcd	313bc	309de	234b	249bc	249cd	244ef	289a	313a	316bc	306a	279cd	288a	293cde	286cd
4. WD X HRC	331d	317e	324c	324g	251c	264c	259d	258h	314a	326a	338d	326a	299f	302a	307e	303f
5. WD X MB	300abc	290ab	308bc	299bc	221a	247bc	228bc	232cd	298a	325a	301ab	308a	273bc	289a	279bc	280bc
6. WD X HY	321cd	316e	331c	323fg	232b	253bc	238bcd	241def	308a	293a	309b	303a	287de	287a	292cde	289de
7. MB X HRC	322cd	309cde	319c	317efg	243bc	247bc	215b	235cde	318a	319a	318bc	318a	295ef	292a	284bc	290de
8. HRC X HY	311bcd	308cde	319c	312def	239bc	260bc	242cd	247fg	316a	318a	308b	314a	289def	295a	290cd	291de
9. MB X HY	295ab	300bc	317c	304cd	217a	232ab	215b	221b	285a	308a	283a	292a	266ab	280a	272b	272b
10. (HYXWD)(MBXHRC)	322cd	322e	322c	322fg	243bc	249bc	249cd	247fg	298a	297a	337d	311a	287de	290a	303de	293de
11. Pioneer X304	283a	284a	274a	280a	211a	226a	186a	208a	278a	322a	300ab	300a	257a	278a	253a	263a
Mean	311	305	313	309	232	249	232	237	297	311	315	307	280	288	287	285

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 36. Ear Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Waimanalo Experiment Station, Waimanalo, Oahu

Varieties	May Planting Plants Per Hectare 34,580	44,460	54,340	May Means	July Planting Plants Per Hectare 34,580	44,460	54,340	July Means	September Planting Plants Per Hectare 34,580	44,460	54,340	Sept. Means	Means Over Dates
1. Waimea Dent	188fg*	191fg	199cde	193gh	175d	155bc	171c	167d	125cd	139e	143d	136f	165de
2. H R C	171cde	174def	201de	182ef	-	-	-	-	-	-	-	-	-
3. Mayorbella	159c	155c	171c	162c	161cd	150bc	160bc	157cd	116bc	117abc	118ab	117bc	145b
4. Hawaiian Yellow	182ef	167cde	182cd	177def	145bc	144b	155bc	148bc	124cd	117abc	121ab	121bc	148b
5. WD X HRC	199g	187efg	210e	199h	176d	157bc	169c	167d	132a	134de	127bc	131ef	166e
6. WD X MB	161cd	164cd	180cd	168cd	151bc	145b	146bc	148bc	109ab	113ab	127bc	116a	144b
7. WD X HY	202g	185defg	196cde	194gh	163cd	168c	164c	165d	124cd	131de	140cd	131ef	163de
8. MB X HRC	188fg	170cde	189cd	182ef	174d	148bc	162bc	161d	117bc	125bcd	125bc	122bcd	155c
9. HRC X HY	175def	200g	185cd	187fg	154c	152bc	155bc	154cd	112abc	132de	130bcd	125cde	155c
10. MB X HY	172cdef	168cde	180cd	173de	148bc	137b	159bc	148bc	120bcd	111a	127bc	119bc	147b
11. (HYXWD)X(MBXHRC)	182ef	192fg	183cd	186fg	162cd	158bc	165c	162d	122bcd	129cde	137cd	129def	159cd
12. Pioneer X304	157c	153c	170c	160c	136b	142b	133b	137b	103a	106a	110a	106a	134a
13. Pioneer 3175	114b	112b	117b	114b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	109b	107b	116b	111b	-	-	-	-	-	-	-	-	-
15. IXL 9	88a	87a	95a	90a	77a	82a	86a	82a	-	-	-	-	-
Mean	163	161	171	180	152	145	152	149	118	123	127	123	153

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 37. Ear Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Kauai Branch Station, Kapaa, Kauai

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	September Planting Plants Per Hectare			Sept.	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	183g*	171d	164d	172g	133c	175d	144cd	151f	114ab	95ab	110	113bc	145c
2. H R C	156def	140c	137bc	144de	110ab	148ab	140bcd	133bcd	-	-	-	-	-
3. Mayorbella	148def	137c	140bcd	142de	110ab	144ab	118a	124ab	107ab	95a	95abc	99a	121bc
4. Hawaiian Yellow	144de	156cd	156cd	152ef	121bc	148ab	137abcd	135cd	95ab	114ab	106abc	105bc	131d
5. WD X HRC	167fg	160cd	160cd	162fg	125bc	171cd	148d	148ef	118b	125b	110abc	118c	143e
6. WD X MB	137d	148cd	160cd	148de	114ab	141ab	125abc	127abc	99ab	98a	114bc	104bc	126bcd
7. WD X HY	152def	148cd	144bcd	148de	118abc	160bcd	137abcd	138d	106ab	110ab	110abc	109bc	132d
8. MB X HRC	160ef	137c	137bc	144de	122bc	156abc	122ab	133bcd	91a	106ab	106abc	101a	126bcd
9. HRC X HY	152def	160cd	144bcd	152ef	114ab	152ab	137abcd	134bcd	98ab	106ab	99abc	101a	129cd
10. MB X HY	152def	137c	125b	138d	118abc	137a	125abc	126abc	95ab	106ab	91ab	97a	121b
11. (HYXWD)X(MBXHRC)	160ef	152cd	156cd	156ef	125bc	153ab	140bcd	139de	114ab	95a	118c	109bc	131d
12. Pioneer X304	118c	110b	95a	108c	102a	137a	118a	119a	91a	110ab	84a	95a	107a
13. Pioneer 3175	103bc	91a	91a	95b	-	-	-	-	-	-	-	-	-
14. Pioneer 3306	83a	79a	83a	82a	-	-	-	-	-	-	-	-	-
15. IXL 9	91ab	79a	83a	84ab	-	-	-	-	-	-	-	-	-
Mean	140	134	131	135	118	152	132	134	102	107	104	103	128

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 38. Ear Height of Corn (cm) as Influenced by Plant Population and Date of Planting at Volcano Experiment Station, Volcano, Hawaii

Varieties	May Planting Plants Per Hectare			May	July Planting Plants Per Hectare			July	Means Over
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	Dates
1. Waimea Dent	160abc*	160a	191cd	170c	134a	158a	183cd	158bc	164a
2. H R C	158abc	174a	197d	176c	153a	170a	186d	169bc	172a
3. Mayorbella	150abc	155a	163bcd	156bc	145a	151a	170cd	155bc	156a
4. Hawaiian Yellow	153abc	163a	163bcd	159bc	147a	157a	154cd	153bc	156a
5. WD X HRC	164abc	175a	197d	179c	160a	170a	187a	172c	175a
6. WD X MB	172bc	175a	167bcd	172c	159a	167a	160cd	162bc	167a
7. WD X HY	160abc	136a	160bc	152bc	155a	131a	143bcd	143abc	147a
8. MB X HRC	182c	182a	166bcd	176c	183a	170a	161cd	171bc	174a
9. HRC X HY	178bc	173a	156bc	169c	170a	168a	158cd	165bc	167a
10. MB X HY	174bc	185a	159bc	172c	167a	179a	156cd	167bc	170a
11. (HYXWD)(MBXHRC)	165abc	147a	179cd	163c	160a	141a	176cd	159bc	161a
12. Pioneer X304	142abc	183a	135ab	153bc	136a	175a	135abc	148bc	151a
13. Pioneer 3175	131ab	158a	106a	132ab	125a	154a	118a	132abc	132a
14. Pioneer 3306	146abc	142a	112a	134ab	139a	141a	113a	131ab	132a
15. IXL 9	118a	136a	101a	118a	115a	131a	108a	118a	118a
Mean	157	163	157	159	150	157	154	153	156

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 39. Ear Height of Corn (cm) as Influenced by Plant Population at Three Dates of Planting and Two Locations

Varieties	Waimanalo Plants Per Hectare			Waimanalo	Kauai Plants Per Hectare			Kauai	Means Over Location Plants Per Hectare			Variety
	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means	34,580	44,460	54,340	Means
1. Waimea Dent	163fg*	162c	171d	165de	143d	153e	139c	145e	153e	155e	158f	155g
2. Mayorbella	145bc	141ab	150b	145b	122bc	125ab	118bc	121bc	134b	134b	133ab	133b
3. Hawaiian Yellow	150cd	143ab	152bc	148b	120bc	139cd	133c	131d	135bc	143cd	141bcd	139cd
4. WD X HRC	169g	159c	168cd	166e	137cd	152de	139c	143e	153e	154e	156ef	154g
5. WD X MB	141b	141ab	151bc	144b	116b	129abc	133c	126bcd	128b	142bcd	135ab	135bc
6. WD X HY	163fg	161c	166bcd	163de	125bc	139cd	130bc	132d	144d	148de	150def	147f
7. MB X HRC	159ef	147b	158bcd	155e	124bc	133bc	121bc	126bcd	142cd	140bcd	140bc	140de
8. HRC X HY	147bc	161c	157bc	155c	121bc	139cd	126bc	129cd	134b	142bcd	150def	142de
9. MB X HY	147bc	138ab	155bc	147b	121bc	127abc	114ab	121b	134b	135bc	132ab	134b
10. (HYXWD)(MBXHRC)	155de	160c	162bcd	159cd	133bcd	133bc	128bc	131d	144d	152e	146cde	145ef
11. Pioneer X304	132a	133a	137a	134a	104a	119a	99a	107a	118a	118a	126a	121a
Mean	152	150	157	153	124	135	127	128	138	142	141	140

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 40. Ear Height of Corn (cm) as Influenced by Plant Population at Two Dates of Planting and Three Locations

Varieties	Waimanalo Plants Per Hectare 34,580	Waimanalo Plants Per Hectare 44,460	Waimanalo Plants Per Hectare 54,340	Waimanalo Means	Kauai Plants Per Hectare 34,580	Kauai Plants Per Hectare 44,460	Kauai Plants Per Hectare 54,340	Kauai Means	Volcano Plants Per Hectare 34,580	Volcano Plants Per Hectare 44,460	Volcano Plants Per Hectare 54,340	Volcano Means	Means Over Locations Plants Per Hectare 34,580	Means Over Locations Plants Per Hectare 44,460	Means Over Locations Plants Per Hectare 54,340	Variety Means
1. Waimea Dent	181de*	173bcd	185bc	180ef	158d	173e	154d	161c	147a	159a	187b	164a	162bc	168a	175cd	168de
2. Mayorbella	160b	152a	166ab	159b	129bc	140bc	129bc	133b	148a	153a	166ab	156a	146b	149a	154b	149b
3. Hawaiian Yellow	164bc	155a	168b	162bc	133bc	152bcd	146cd	144b	150a	160a	158ab	156a	149bc	156a	157b	154bc
4. WD X HRC	187e	172bc	189c	183f	146cd	165de	154d	155bc	162a	172a	192b	175a	165bc	170a	178d	171e
5. WD X MB	156b	154a	163ab	158b	125b	144bc	142bcd	137b	166a	171a	163ab	167a	149bc	157a	156b	154bc
6. WD X HY	182e	177d	180bc	179ef	135bc	154cd	140bcd	143b	157a	133a	152ab	147a	158bc	155a	157b	157bc
7. MB X HRC	181de	159ab	175bc	172de	141c	146bc	129bcd	139b	182a	176a	163ab	174a	168c	160a	156b	161cd
8. HRC X HY	165bc	176cd	170b	170cd	133bc	156cd	140bcd	143b	174a	170a	157ab	167a	157bc	167a	156b	160cd
9. MB X HY	160b	152a	170b	160b	135bc	137ab	125b	132b	170a	182a	157ab	170a	155bc	157a	151b	154bc
10. (HYXWD)(MBXHRC)	172cd	175cd	174bc	174de	142c	152bcd	148d	147bc	162a	144a	177ab	161a	159bc	157a	166bc	161cd
11. Pioneer X304	146a	147a	151a	148a	110a	123a	106a	113a	139a	179a	135a	151a	132a	150a	131a	137a
Mean	169	163	172	168	135	149	138	140	160	164	164	162	154	159	158	157

*Means within the same column followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 41. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Waimanalo for Three Dates of Planting Across Plant Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling	Mosaic
MAY									
Days to silking	1.0000	0.4450	0.5056	-0.2026	0.2344	-0.0636	0.5273	0.9106	
Plant height		1.0000	0.7073	0.3097	0.4159	0.1452	0.1963	0.4239	
Ear height			1.0000	0.2356	0.3118	0.0904	0.2603	0.4634	
Ear yield				1.0000	0.5498	0.2708	-0.1989	-0.1398	
Stover yield					1.0000	0.0410	0.0918	0.2289	
Ear length						1.0000	-0.0249	-0.0622	
Tassel-silk							1.0000	0.1290	
Days to tasseling								1.0000	
Mosaic									1.0000
JULY									
Days to silking	1.0000	0.1172	0.2368	-0.2747	0.1836	-0.1595	0.3922	0.7594	
Plant height		1.0000	0.7702	0.0579	0.1307	0.2044	0.1516	0.0143	
Ear height			1.0000	0.0941	0.2107	0.0724	0.0677	0.1976	
Ear yield				1.0000	0.3154	-0.0231	-0.2750	-0.0903	
Stover yield					1.0000	-0.1807	-0.0575	0.2310	
Ear length						1.0000	-0.0081	-0.1597	
Tassel-silk							1.0000	-0.3006	
Days to tasseling								1.0000	
Mosaic									1.0000
SEPTEMBER									
Days to silking	1.0000	0.1695	0.3689	-0.5872	0.3852	-0.2753	0.8045	0.5785	
Plant height		1.0000	0.7909	0.0754	0.2583	-0.0748	0.2782	-0.0968	
Ear height			1.0000	-0.0450	0.3584	-0.0677	0.3165	0.1864	
Ear yield				1.0000	0.0677	0.3248	-0.5390	-0.2481	
Stover yield					1.0000	-0.0381	0.2565	0.2962	
Ear length						1.0000	-0.4263	0.1220	
Tassel-silk							1.0000	-0.0191	
Days to tasseling								1.0000	
Mosaic									1.0000

Table 42. Correlation Matrix for the Components of Growth and Yield of Corn at Kauai for Three Dates of Planting Across Plant Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling	Mosaic
MAY									
Days to silking	1.0000	0.5426	0.4688	-0.6862	0.3057	0.1949	0.5909	0.8827	
Plant height		1.0000	0.8578	-0.4058	0.5339	0.5819	0.4002	0.4326	
Ear height			1.0000	-0.3362	0.5094	0.3341	0.4264	0.3268	
Ear yield				1.0000	0.0423	-0.1218	-0.2428	-0.7005	
Stover yield					1.0000	0.3199	0.3638	0.1631	
Ear length						1.0000	0.0569	0.2060	
Tassel-silk							1.0000	0.1425	
Days to tasseling								1.0000	
JULY									
Days to silking	1.0000	0.0356	0.0083	-0.3566	0.1971	-0.3076	0.4289	0.8533	
Plant height		1.0000	0.8702	0.3020	0.3924	0.3491	-0.0369	0.0605	
Ear height			1.0000	0.1636	0.5060	0.1996	-0.0218	0.0217	
Ear yield				1.0000	-0.0947	0.7317	-0.4694	-0.1216	
Stover yield					1.0000	-0.1614	0.2394	0.0787	
Ear length						1.0000	-0.4454	-0.0815	
Tassel-silk							1.0000	-0.1051	
Days to tasseling								1.0000	
Mosaic									1.0000
SEPTEMBER									
Days to silking	1.0000	0.0551	-0.0011	-0.1561	0.4645	-0.3665	0.7301	0.6289	
Plant height		1.0000	0.8006	0.0976	0.3799	0.1495	0.1404	-0.0793	
Ear height			1.0000	0.0488	0.3259	0.1253	0.1002	-0.1156	
Ear yield				1.0000	-0.0278	0.5628	-0.1213	-0.0898	
Stover yield					1.0000	-0.3406	0.3082	0.3274	
Ear length						1.0000	-0.2600	-0.2391	
Tassel-silk							1.0000	-0.0720	
Days to tasseling								1.0000	
Mosaic									1.0000

Table 43. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Volcano for Two Dates of Planting Across Plant Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length
MAY						
Days to silking	1.0000	0.5806	0.5482	0.1916	0.3187	0.1120
Plant height		1.0000	0.7923	0.2557	0.3612	0.1013
Ear height			1.0000	0.1776	0.3061	0.0559
Ear yield				1.0000	0.4081	0.2941
Stover yield					1.0000	0.2376
Ear length						1.0000
JULY						
Days to silking	1.0000	0.5530	0.5152	0.0002	0.3227	0.3101
Plant height		1.0000	0.7279	0.2459	0.4718	0.3072
Ear height			1.0000	0.2484	0.4483	0.2437
Ear yield				1.0000	0.5612	0.3459
Stover yield					1.0000	0.2605
Ear length						1.0000

Table 44. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Waimanalo for Three Dates of Planting Across Three Plant Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling	Mosaic
Days to silking	1.0000	-0.3058	-0.2488	-0.5436	-0.2024	-0.4302	0.7598	0.6863	
Plant height		1.0000	0.9194	0.5842	0.6655	0.6139	-0.3516	-0.0764	
Ear height			1.0000	0.5602	0.6649	0.5732	-0.3378	-0.0043	
Ear yield				1.0000	0.6371	0.5206	-0.5295	-0.2427	
Stover yield					1.0000	0.4174	-0.2839	0.0066	
Ear length						1.0000	-0.5081	-0.0925	
Tassel-silk							1.0000	0.0486	
Days to tasseling								1.0000	
Mosaic									1.0000

Table 45. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Kauai for Three Dates of Planting Across Three Plant Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling
Days to silking	1.0000	0.0712	0.0477	-0.4900	0.2043	-0.1535	0.6082	0.8266
Plant height		1.0000	0.9045	0.3385	0.5779	0.7034	0.0251	0.0717
Ear height			1.0000	0.2505	0.5616	0.5477	0.0437	0.0289
Ear yield				1.0000	0.2775	0.5639	-0.2549	-0.4356
Stover yield					1.0000	0.3184	0.2093	0.1085
Ear length						1.0000	-0.2060	-0.0470
Tassel-silk							1.0000	0.0560
Days to tasseling								1.0000

Table 46. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Volcano for Two Dates of Planting Across Three Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length
Days to silking	1.0000	0.5645	0.4837	0.5592	0.5837	0.3517
Plant height		1.0000	0.7605	0.2971	0.4241	0.2596
Ear height			1.0000	0.1905	0.3320	0.1767
Ear yield				1.0000	0.7393	0.4192
Stover yield					1.0000	0.3774
Ear length						1.0000

Table 47. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn for Date of Planting Across Three Locations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length
MAY						
Days to silking	1.0000	0.1672	0.0477	0.0452	-0.1489	0.2249
Plant height		1.0000	0.7975	-0.2853	0.2755	0.3105
Ear height			1.0000	-0.2075	0.3374	0.1845
Ear yield				1.0000	0.1799	0.0150
Stover yield					1.0000	0.1688
Ear length						1.0000
JULY						
Days to silking	1.0000	0.3449	0.2351	-0.5776	-0.5076	0.4299
Plant height		1.0000	0.7615	0.0203	0.0451	0.6353
Ear height			1.0000	0.0788	0.2228	0.3872
Ear yield				1.0000	0.4288	0.0745
Stover yield					1.0000	-0.2582
Ear length						1.0000

Table 48. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn for Dates of Planting Across Locations and Populations

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling
MAY								
Days to silking	1.0000	-0.3967	-0.2140	-0.1149	0.1263	0.0521	0.7460	0.9404
Plant height		1.0000	0.8703	-0.4035	0.3458	0.3087	-0.3011	-0.3704
Ear height			1.0000	-0.3536	0.3814	0.2393	-0.1177	-0.2226
Ear yield				1.0000	0.1470	-0.0554	0.0306	-0.1674
Stover yield					1.0000	0.2242	0.1840	0.0729
Ear length						1.0000	-0.0014	0.0696
Tassel-silk							1.0000	0.4750
Days to tasseling								1.0000
JULY								
Days to silking	1.0000	-0.6757	-0.3746	-0.4447	-0.1677	-0.5420	0.5633	0.9547
Plant height		1.0000	0.8191	0.3854	0.3942	0.5464	-0.3189	-0.6674
Ear height			1.0000	0.2743	0.4670	0.3494	-0.1934	-0.3639
Ear yield				1.0000	0.1435	0.5427	-0.4707	-0.3452
Stover yield					1.0000	0.0040	-0.0356	-0.1813
Ear length						1.0000	-0.4122	-0.4790
Tassel-silk							1.0000	0.2920
Days to tasseling								1.0000
SEPTEMBER								
Days to silking	1.0000	-0.4679	-0.1969	-0.2090	0.4323	-0.5084	0.6163	0.7767
Plant height		1.0000	0.7952	-0.0598	0.0066	0.4169	0.1073	-0.6799
Ear height			1.0000	-0.0511	0.1785	0.2691	0.1610	-0.3787
Ear yield				1.0000	0.0310	0.3270	-0.3315	-0.0002
Stover yield					1.0000	-0.2840	0.2533	0.3462
Ear length						1.0000	-0.3192	-0.3901
Tassel-silk							1.0000	-0.0175
Days to tasseling								1.0000

Table 49. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Three Locations in Two Dates of Planting

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length
Days to silking	1.0000	0.2579	0.1444	-0.0907	-0.2443	0.3195
Plant height		1.0000	0.7955	0.0576	0.2651	0.5575
Ear height			1.0000	0.0767	0.3553	0.3706
Ear yield				1.0000	0.4476	0.3018
Stover yield					1.0000	0.1404
Ear length						1.0000

Table 50. Correlation Coefficient Matrix for the Components of Growth and Yield of Corn at Waimanalo and Kauai for Three Dates of Planting

	Days to Silking	Plant Height	Ear Height	Ear Yield	Stover Yield	Ear Length	Days from Tassel-silk	Days to Tasseling
Days to silking	1.0000	-0.5276	-0.3466	-0.2755	-0.0276	-0.3612	0.6473	0.8926
Plant height		1.0000	0.8951	0.2559	0.5077	0.6465	-0.3099	-0.4897
Ear height			1.0000	0.2848	0.5815	0.5900	-0.2528	-0.2925
Ear yield				1.0000	0.3832	0.5044	-0.3049	-0.1710
Stover yield					1.0000	0.3570	-0.0629	0.0020
Ear length						1.0000	-0.3817	-0.2350
Tassel-silk							1.0000	0.2341
Days to tasseling								1.0000

Table 51. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield and Ear Length of Corn Grown at Waimanalo Experiment Station at Each of Three Dates of Planting

Sources	Days to tasseling			Days to silking		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2*	2 n.s.	2*	2 n.s.	2 n.s.	2 n.s.
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10**
V x P	28 n.s.	22 n.s.	20 n.s.	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

Sources	Plant height (cm)			Ear height (cm)		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2 n.s.	2*	2**	2*	2 n.s.	2**
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10**
V x P	28 n.s.	22 n.s.	20 n.s.	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

*Significant at the 5% level.
**Significant at the 1% level.

Table 51. (Continued) Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield and Ear Length of Corn Grown at Waimanalo Experiment Station at Each of Three Dates of Planting

Sources	Ear yield (kg/ha)			Stover yield (kg/ha)		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2**	2**	2**	2 n.s.	2**	2**
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10**
V x P	28 n.s.	22 n.s.	20 n.s.	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

Sources	Ear length (cm)		
	May	July	September
	d.f.	d.f.	d.f.
R	3	3	3
P	2**	2**	2 n.s.
P x R	6	6	6
V	14**	11**	10**
V x P	28 n.s.	22*	20 n.s.
V x R	42	33	30
V x P x R	84	66	60
Total	179	143	131

Table 52. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield, and Ear Length of Corn Grown at Waimanalo Experiment Station

Sources	d.f.	Days to tasseling	Days to silking	Plant ht (cm)	Ear ht (cm)	Ear yld (kg/ha)	Stover yld (kg/ha)	Ear lt (cm)
R	3							
D	2	**	**	**	**	**	**	**
D x R	6							
P	2	n.s.	n.s.	**	**	**	**	**
P x D	4	**	n.s.	**	n.s.	*	*	**
P x R	6							
P x D x R	12							
V	10	**	**	**	**	**	**	**
V x D	20	**	**	**	n.s.	**	n.s.	**
V x P	20	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x P x D	40	n.x.	n.x.	n.x.	n.x.	n.x.	n.x.	*
V x R	30							
V x D x R	60							
V x P x R	60							
VxPxDxR	120							
Total	395							

*Significant at the 5% level.
**Significant at the 1% level.

Table 53. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield and Ear Length of Corn Grown at Kauai Branch Station at Each of Three Dates of Planting

Sources	Days to tasseling			Days to silking		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2**	2*	2 n.s.	2**	2 n.s.	2 n.s.
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10**
V x P	28 n.s.	22 n.s.	20 n.s.	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

Sources	Plant height			Ear height		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2 n.s.	2**	2 n.s.	2 n.s.	2*	2 n.s.
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10*
V x P	28 n.s.	22*	20 n.s.	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

*Significant at the 5% level.
**Significant at the 1% level.

Table 53. (Continued) Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield and Ear Length of Corn Grown at Kauai Branch Station at Each of Three Dates of Planting

Sources	Ear yield (kg/ha)			Stover yield (kg/ha)		
	May	July	September	May	July	September
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2*	2**	2 n.s.	2**	2 n.s.	2 n.s.
P x R	6	6	6	6	6	6
V	14**	11**	10**	14**	11**	10**
V x P	28**	22 n.s.	20 n.s.	28**	22 n.s.	20 n.s.
V x R	42	33	30	42	33	30
V x P x R	84	66	60	84	66	60
Total	179	143	131	179	143	131

Sources	Ear length (cm)		
	May	July	September
	d.f.	d.f.	d.f.
R	3	3	3
P	2**	2 n.s.	2 n.s.
P x R	6	6	6
V	14**	11**	10**
V x P	28 n.s.	22 n.s.	20 n.s.
V x R	42	33	30
V x P x R	84	66	60
Total	179	143	131

Table 54. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield, and Ear Length of Corn Grown at Kauai Branch Station

Sources	d.f.	Days to tasseling	Days to silking	Plant ht (cm)	Ear ht (cm)	Ear yld (kg/ha)	Stover yld (kg/ha)	Ear lt (cm)
R	3							
D	2	n.s.	**	**	**	**	**	**
D x R	6							
P	2	n.s.	n.s.	*	n.s.	**	n.s.	**
P x D	4	**	**	*	n.s.	*	n.s.	**
P x R	6							
P x D x R	12							
V	10	**	**	**	**	**	**	**
V x D	20	*	*	**	**	n.s.	**	**
V x P	20	n.s.	n.s.	n.s.	n.s.	n.s.	*	n.s.
V x P x D	40	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x R	30							
V x D x R	60							
V x P x R	60							
VxPxDxR	120							
Total	395							

*Significant at the 5% level.
**Significant at the 1% level.

Table 55. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield and Ear Length of Corn Grown at Volcano Experiment Station at Each of Two Dates of Planting

Sources	Days to silking		Plant height (cm)		Ear height (cm)	
	May	July	May	July	May	July
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2**	2 n.s.	2**	2**	2 n.s.	2 n.s.
P x R	6	6	6	6	6	6
V	14**	14**	14**	14**	14**	14**
V x P	28 n.s.	28 n.s.	28 n.s.	28 n.s.	28 n.s.	28 n.s.
V x R	42	42	42	42	42	42
V x P x R	84	84	84	84	84	84
Total	179	179	179	179	179	179

Sources	Ear yield (kg/ha)		Stover yield (kg/ha)		Ear length (cm)	
	May	July	May	July	May	July
	d.f.	d.f.	d.f.	d.f.	d.f.	d.f.
R	3	3	3	3	3	3
P	2**	2 n.s.	2**	2*	2 n.s.	2 n.s.
P x R	6	6	6	6	6	6
V	14**	14**	14**	14**	14**	14**
V x P	28 n.s.	28 n.s.	28 n.s.	28*	28*	28 n.s.
V x R	42	42	42	42	42	42
V x P x R	84	84	84	84	84	84
Total	179	179	179	179	179	179

*Significant at the 5% level.
**Significant at the 1% level.

Table 56. Key out Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield, and Ear Length of Corn Grown at Volcano Experiment Station

Sources	d.f.	Silking	Plant ht (cm)	Ear ht (cm)	Ear yld (kg/ha)	Stover yld (kg/ha)	Ear lt (cm)
R	3						
D	1	**	**	*	**	**	*
D x R	3						
P	2	**	n.s.	n.s.	*	**	n.s.
P x D	2	n.s.	n.s.	n.s.	*	n.s.	n.s.
P x R	6						
P x D x R	6						
V	10	n.s.	n.s.	n.s.	**	**	*
V x D	10	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x P	20	n.s.	n.s.	n.s.	*	*	*
V x P x D	20	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x R	30						
V x D x R	30						
V x P x R	60						
VxPxDxR	60						
Total	263						

*Significant at the 5% level.
**Significant at the 1% level.

Table 57. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield, and Ear Length of Corn Grown at Three Locations and Three Dates of Planting

Sources	d.f.	Silking	Plant ht (cm)	Ear ht (cm)	Ear yld (kg/ha)	Stover yld (kg/ha)	Ear lt (cm)
R	3						
D	1	**	**	**	**	**	**
D x R	3						
L	2	**	**	**	**	**	**
L x D	2	**	**	*	**	**	**
Error (a)	12						
P	2	**	**	n.s.	*	**	**
P x D	2	**	n.s.	n.s.	n.s.	n.s.	**
P x L	4	*	**	*	**	**	**
P x L x D	4	n.s.	**	*	*	n.s.	**
Error (b)	36						
V	10	**	n.s.	**	**	**	**
V x D	10	n.s.	n.s.	**	n.s.	**	**
V x L	20	n.s.	*	**	**	**	**
V x L x D	20	*	**	n.s.	n.s.	n.s.	**
V x P	20	n.s.	n.s.	n.s.	n.s.	n.s.	*
V x P x D	20	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x P x L	40	**	n.s.	n.s.	*	n.s.	n.s.
VxPxLxD	40	n.s.	n.s.	n.s.	*	n.s.	n.s.
V x R	30						
V x D x R	30						
V x L x R	60						
VxLxDxR	60						
V x P x R	60						
VxPxDxR	60						
VxPxLxR	120						
VxPxLxDxR	120						
Total	791						

*Significant at the 5% level.
**Significant at the 1% level.

Table 58. Key out of Degrees of Freedom and Significance Levels for the Analysis of Variance for Days to Tasseling, Days to Silking, Plant Height, Ear Height, Ear Yield, Stover Yield, and Ear Length of Corn Grown at Two Locations and Three Dates of Planting

Sources	d.f.	Days to tasseling	Days to silking	Plant ht (cm)	Ear ht (cm)	Ear yld (kg/ha)	Stover yld (kg/ha)	Ear lt (cm)
R	3							
D	2	**	**	**	**	**	**	**
D x R	6							
L	1	**	**	**	**	**	**	**
L x D	2	**	**	n.s.	*	**	*	**
L x R	3							
L x D x R	6							
P	2	n.s.	n.s.	n.s.	n.s.	**	n.s.	**
P x D	4	**	n.s.	n.s.	n.s.	**	n.s.	**
P x L	2	n.s.	n.s.	**	**	**	**	*
P x L x D	4	**	**	**	*	**	n.s.	**
P x R	6							
P x D x R	12							
P x L x R	6							
PxLxDxR	12							
V	10	**	**	**	**	**	**	**
V x D	20	**	**	**	**	n.s.	**	**
V x L	10	**	**	**	*	**	**	**
V x L x D	20	n.s.	**	**	*	n.s.	n.s.	**
V x P	20	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x P x D	40	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x P x L	20	n.s.	n.s.	n.s.	n.s.	*	*	n.s.
VxPxLxD	40	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
V x R	30							
V x D x R	60							
V x L x R	30							
VxLxDxR	60							
V x P x R	60							
VxPxDxR	120							
VxPxLxR	60							
VxPxLxDxR	120							
Total	791							

*Significant at the 5% level.
**Significant at the 1% level.

Table 59. Monthly Rainfall, Temperature, Relative Humidity (R.H.) and Solar Radiation Data Collected at Waimanalo Experiment Station, Kauai Branch Station and Volcano Experiment Station During the Period May, 1970 to January, 1971

Month	WAIMANALO			KAUAI					VOLCANO					
	Rainfall (inches)	Minimum Temperature (°F)	Maximum Temperature (°F)	Rainfall (inches)	Minimum Temperature (°F)	Maximum Temperature (°F)	Minimum R.H. (%)	Maximum R.H. (%)	Rainfall (inches)	Minimum Temperature (°F)	Maximum Temperature (°F)	Minimum R.H. (%)	Maximum R.H. (%)	Solar Radiation (gm-cal/cm^2)
May	1.2	71	82	6.6	68	80	69	96	14.2	51	63	72	100	9,864
June	0.5	72	82	3.6	64	80	67	67	3.4	51	63	77	100	11,352
July	1.9	72	84	5.8	70	80	70	98	6.3	52	64	71	100	11,424
August	1.3	72	85	5.1	71	81	71	97	10.8	53	65	72	100	10,488
September	1.0	72	86	4.6	70	81	71	96	5.5	51	66	68	100	9,928
October	4.7	72	83	5.0	70	81	71	96	5.2	50	65	70	100	9,640
November	21.6	69	80	9.6	67	77	76	96	8.2	49	64	70	100	7,696
December	24.3	69	78	9.3	68	75	80	99	25.5	48	58	80	100	6,640
January	12.3	63	76	11.6	61	75	70	93	26.6	47	62	67	100	7,152

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